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INSTRUCTION BOOK

RM-8E
MULTIPLE MODEM SYSTEM

PART OF

FLIGHT SERVICE AUTOMATION SYSTEM

CONTRACT DTFA01-81-C-10039

CONTRACTOR

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RECORD OF CHANGES

CHANGE TO BASIC	SUPPLEMENTS			OPTIONAL USE	CHANGE TO BASIC	SUPPLEMENTS			OPTIONAL USE

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PREFACE

IMPORTANT INSTRUCTIONS TO USER

The Rm-8E Direct Connect Multiple Modem System (enclosure) is approved by the Federal Communications Commission (FCC) as not being harmful to the telephone network when connected directly to the telephone lines. To fully comply with Part 68, FCC Docket 19528, the following guidelines should be read carefully and followed completely where applicable:

1. The FCC Rules require that all direct connections to the telephone lines must be made through standard plugs and jacks as specified in the Rules. No connection can be made to party lines or coin lines. The following actions are required prior to connecting the modem system:

   a. Call your local telephone company and inform them that you wish to connect an FCC registered device to their lines. Give them the 14-digit FCC Registration Number AK396F-67127-DM-E and the Ringer Equivalence Number 0.3B, located on the label on the outside surface of the device.

   b. Inform your local telephone company of the jack (Connector RJ11C) required for the device.

   c. After the telephone company has installed the jack, connect the modem system by inserting the modular plug of the equipment into the modular jack.

   d. Operation of your modem system is described in section 2 of this manual.

2. If it appears that the modem system is malfunctioning, disconnect the unit from the telephone line until either the equipment or the telephone line is identified as the source of the trouble. If your equipment needs repair, it should not be reconnected until the repairs are made. If the telephone company notes out-of-limit parameters on your modem, it may disconnect your service until the problem is corrected.

SECTION I

GENERAL INFORMATION

1.1 INTRODUCTION. The Universal Data Systems (UDS) RM-8E direct connect multiple modem system contains the RM-8E chassis and the configured printed circuit (PC) cards. The modem system may be configured as follows:

1. 1 to 8 leased line modems (either RM-208A or RM-9600).
2. 1 to 4 RM-208A modems with 1 to 4 RM-A/O cards.
3. 1 to 4 RM-208A modems with 1 to 4 RM-A/O cards and one manual call unit (RM-800).

The following PC cards may be used in the RM-8E enclosure:

Part Number	Model	Description
2092284	RM-9600	Modem, 9600 bps, 4-wire full-duplex, leased line
2082278	RM-208A	Modem, 4800 bps, 4-wire full-duplex, leased line (or DDD network when used in conjunction with the RM-A/O)
1020377	RM-800	Manual Call Unit (MCU), placed in Slot 0 in the housing
1020364	RM-A/O	Answer or originate unit paired with the RM-208A, converts leased line modem to 4-wire DDD network modem
1020249J	RM-8E	Switching power supply unit. Enclosure contains two power supply PC cards.

1.2 DESCRIPTION. The modems, RM-A/O, MCU, and power supplies are plug-in PC cards, accessible through the hinged front panel. All active cards may be installed or replaced from the front of the unit without wiring or cable alterations. Each PC card modem has light emitting diodes (LEDs) that may be viewed through translucent windows in the front panel as shown in figure 1-1. This allows continuous monitoring of the operating conditions of all PC cards. With the front panel lowered, the modem test switches located on the front edge bracket of each modem card are accessible as shown in a typical modem configuration, figure 1-2.

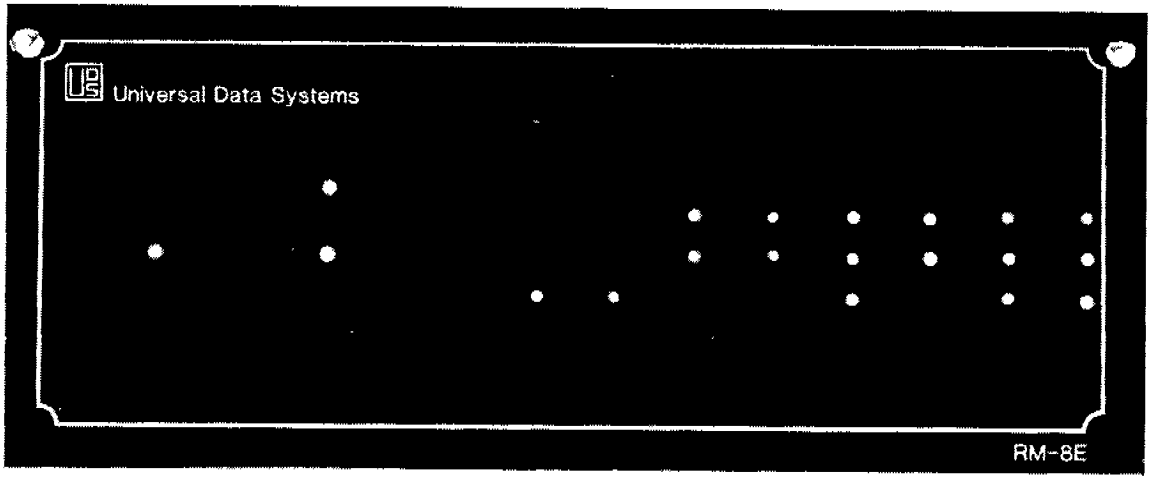

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Figure 1-1. UDS Model RM-8E Direct Connect Multiple Modem Enclosure

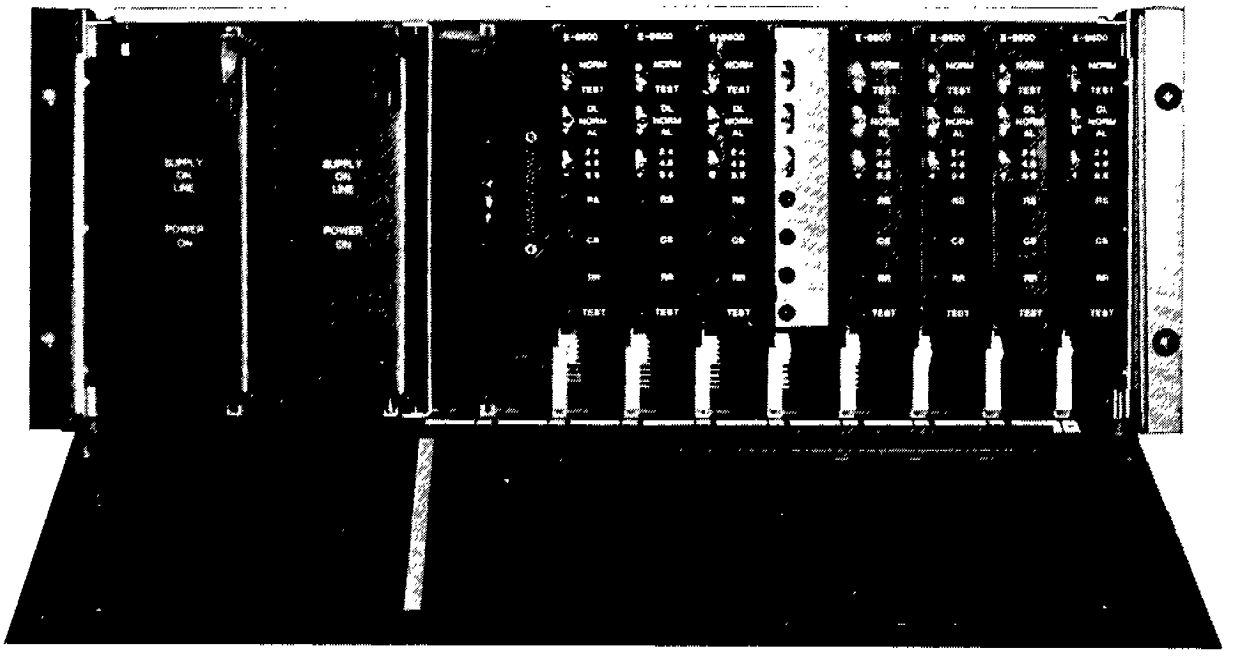

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Figure 1-2. UDS Model RM-8E With Front Panel Open

The RM-8E unit contains dual power supply modules that are continuously monitored for proper operation. Out-of-tolerance conditions are reported by a flashing front panel LED. If an improper operation is detected, the failed power supply is automatically disconnected, and the standby power supply is connected to provide the modem power. The rear panel contains Telephone (TELCO) and Data Terminal Equipment (DTE) interface connectors for eight modems, a manual call unit, and associated components.

1.3 PRINTED CIRCUIT (PC) CARDS. The RM-8E enclosure accepts RM-208A and RM-9600 modems, RM-A/O interface cards, and the RM-800 manual call unit. The RM-208A is a 4800 bps modem that may be operated individually on a 4-wire leased line, or on a dial up network (DDD) when paired with the RM-A/O card. The enclosure accepts up to eight RM-208A modems when operated on leased lines. The RM-208A has registered protective circuitry and does not require additional data access arrangements when operated on a DDD network. If the RM-208 is operated on the DDD network, a RM-A/O must be paired with it, up to a maximum of four RM-208A's and four RM-A/O's. A manual call unit which allows manual callout on the modems may be used in slot 0 of the enclosure. The RM-9600 is a 9600 bps modem; the RM-8E enclosure accepts up to eight RM-9600 modems.

The RM-A/O card is used to convert the RM-208A from a 4-wire private line modem to a 4-wire dial up modem. The RM-A/O allows automatic answer on two dial up lines, or manual call out on two dial up lines when used with the RM-800 manual call unit. One RM-A/O is required for each RM-208A modem. The RM-A/O is contained in enclosure slot(s) 2, 4, 6, or 8. The associated RM-208A modem occupies enclosure slot(s) 1, 3, 5, or 7.

The RM-800 manual call unit allows manual callout on any dial up RM-208A modem. When paired with a RM-A/O, the RM-208A is a 4-wire dial up modem. The RM-800 always occupies enclosure slot 0.

SECTION II

OPERATION

2.1 GENERAL. Modems used in the enclosure are either RM-9600s or RM-208As. The RM-9600 operates at 9600 bps on private leased lines. The RM-208A operates at 4800 bps on leased lines and dial up (DDD Network) lines. To operate on the DDD network, the modem must be paired with an RM-A/O card. The RM-208A modem will only operate in the 4-wire mode. The modems are controlled by a standardized interface (RS-449) that provides for a orderly information transfer. The enclosure is designed to use a common manual call unit (in slot 0) for establishing outgoing calls. The operator selects the proper modem by dialing (on the associated telephone) the modem number.

The enclosure has two power supplies, each capable of driving the entire load of eight modems and one MCU card. One power supply provides enclosure power while the other power supply remains in a standby mode. Voltage comparison circuits automatically switch to the standby unit if any out-of-tolerance voltage(s) are detected in the on-line power supply.

2.2 RM-800 MCU (Manual Control Unit).

2.2.1 RM-800 MCU Operating Specifications.

MCU Slot Location	always occuppies slot 0 in enclosure
MCU On-line Switch	always set to the bus position
Operational Mode	half-duplex manual call mode
Operator Interface	exclusion key telephone
Modem Slot Select	dial number input via exclusion key telephone
Talk Mode Enable	raise exclusion key on telephone
Data Mode Enable	lower exclusion key on telephone

2.2.2 General. When used with the telephone hand set, the MCU allows the operator to manually call out on any dial up modem in the enclosure. The RM-208A paired with the RM-A/O is a 4-wire dial up modem. The procedure for call origination is to call out on the line associated with the RM-A/O (slot 2, 4, 6, or 8), and then call out on the line associated with the modem. After both calls are established, the RM-A/O transfers the 4-wire network to the modem for data transfer to the called party.

2.2.3 MCU Operation. The toggle switch on the MCU card must always be set to the Bus position. In the idle state, the telephone associated with the MCU card is On Hook; each RM-208A and RM-A/O card in the enclosure has access to its communication line. Refer to figure 2-1 for the MCU operational flow chart diagram.

When the telephone set goes Off Hook, the modem decode circuitry on the MCU card is enabled, and a bias current is supplied to the telephone TIP and RING (Note: Do not pull the exclusion key now). The MCU card occuppies slot 0. The modem and RM-A/O can occupy slots 1 and 2, 3 and 4, 5 and 6, or 7 and 8. The operator must dial out on both slots to establish a 4-wire dial up connection. As a convention, the higher number slot should be dialed first. After the slot number is dialed, the operator must raise the white exclusion key. The exclusion key closure causes the slot number to be latched on the MCU card, and the generation of a talk mode pulse. The talk mode pulse sets a latch on the RM-A/O card which causes the communication line (for that slot) to be connected to the TIP and RING Bus. The telephone set TIP and RING is also connected to the Bus. The operator will hear a dial tone and can proceed with the dial process.

NOTE

> The higher number slot is always the modem receiver. The lower number slot is always the modem transmitter. The operator must dial the answering modem receive line when the higher number slot is used and the answering modem transmit line when the lower number is used.

The telephone is connected to the selected telephone line until the operator lowers the exclusion key on the telephone set. If the call is completed satisfactorily, the operator may transfer the call to the RM-A/O board by lowering the exclusion key and then hanging up the telephone. If the call is not completed satisfactorily, the switch hook key is depressed before the exclusion key is released. The call can be reinitiated from the beginning sequence.

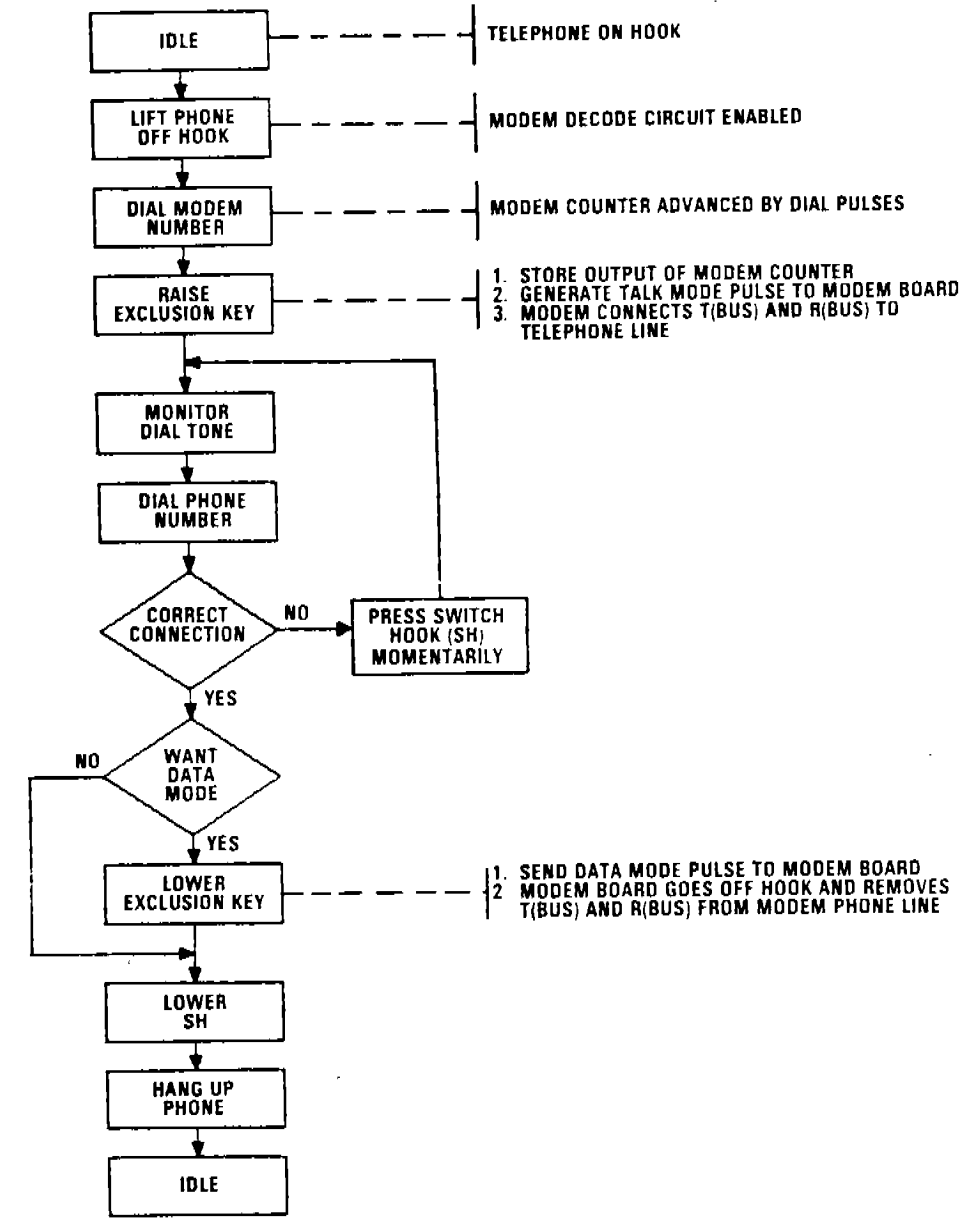

Figure 2-1. RM-800 MCU (Manual Call Unit) Operational Flow Chart

If the call is completed as desired, the exclusion key is first released which generates a data mode pulse to the RM-A/O. The RM-A/O sets a latch to hold an Off Hook condition on line 1. The telephone releases the line to the RM-A/O when the telephone is hung up. The operator should dial out on the associated modem slot number to establish the remainder of the 4-wire dial-up connection. After both calls are established, the RM-A/O will turn the lines over to the RM-208A modem.

2.3 RM-208A MODEM CARD.

2.3.1 RM-208A Operating Specifications.

Data Rate	4800 bps
Modulation	Eight-Phase Differentially Coherent Phase Shift Keying (DCPSK)
Carrier Frequency	1800 Hz
Internal Transmit Clock Frequency	4800 Hz± 0.01%
Transmitter Output Level	Strapped for -10 dBM initially
Line Impedance	600 Ohms, transformer coupled and transient protected
Operation Modes	4-wire, full-duplex private line operation
Digital Interface	Conforms to EIA Standard RS-449
Clear to Send Delay	Strapped for 50 ms
Carrier Detect Level	Strapped for -34 dBM minimum
Line Equalizer	Equalized for C2 conditioned lines
2-Wire/4-Wire	Strapped for 4-wire
Self Test Switch	Toggle Switch for Normal, Self Test and Self Test Receive Only

Loop Test Switch.			Toggle Switch for Normal, Analog Loop, and Digital Loop Testing
LEDs.	1.	TEST	- ON when modem is in any test mode
. . . . .	2.	TR	- ON when the TR line is ON (Terminal Ready)
. . . . .	3.	RR	- ON when Carrier is received by the modem (Receiver Ready)
. . . . .	4.	RS	- ON when the Request to Send line is ON
. . . . .	5.	CS	- ON when the Clear to Send line is On

2.3.2 RM-208A Operation. When both test switches are in the NORMAL position, the RM-208A is under DTE control and normal data transfer occurs. The edge-mounted test switches allow operator testing; these procedures are given in Section IV. The active signals for the RS-449 digital interface and the telephone interface are given in tables 5-1 through 5-3.

2.4 RM-9600 MODEM CARD.

2.4.1 RM-9600 Operating Specifications.

Data Rate	9600 bps
Modulation.	Eight Phase, Four Amplitude QAM Per CCITT V.29
Carrier Frequency	1700 Hz
Internal Transmit Clock Frequency . . .	Selected bit rate $\pm$ .01%
Transmitter Output Level.	Strapped for -6 dBm initially
Line Impedance.	600 Ohms, transformer coupled and transient protected

Operation Mode	4-Wire, full duplex private line operation
Digital Interface	Conforms to EIA Standard RS-449
Clear to Send	253.5 ms Train
Carrier Detect Level	Strapped for -26 dBm minimum
Receiver Equalizer	Automatic Adaptive Equalizer, strapped for 16 baud timer operation
DL and AL Test Switch	Toggle Switch for Normal, Analog Loopback, or Digital Loopback
Self Test Switch	Toggle Switch for Normal or Self Test
Fallback Switch	Toggle Switch set for 9600 bps.
LEDs	1. TEST - ON for any test condition. Flashes OFF for errors in Self Test Mode
	2. RR - ON when Carrier is received by the modem (Receiver Ready)
	3. RS - ON when the Request to Send line is ON
	4. CS - ON when the Clear to Send line is ON

2.4.2 RM-9600 Operation. The RM-9600 is under DTE control with normal data transfer when both test switches are in the NORMAL position. The edge-mounted test switches permit operator testing of the card as explained in Section IV. The active signals for the telephone interface and the RS-449 digital interface are listed in tables 5-1 through 5-3.

2.5 RM-A/O (Answer/Originate) CARD.

2.5.1 RM-A/O Operating Specifications.

Operational Mode	Strapped for either call origination or call answering mode
Call Origination Control	Requires MCU address select, talk mode, and data mode pulse inputs
Answer Tone Frequency	2025 hertz
Answer Tone Duration	2.5 seconds
Answer about time-out	54 seconds
Incoming Call Circuit Isolation	Optical buffer protection
Line Impedance	600 ohms, transformer coupled, and transient protected

2.5.2 General. The RM-A/O converts the RM-208A from a 4-wire private line modem to a 4-wire dial up modem. This allows automatic answer on two dial up lines, or a manual call out on two dial up lines when used with the RM-800 MCU. The RM-A/O card occupies slot(s) 2, 4, 6, or 8 in the RM-8E enclosure. The associated RM-208A occupies slot(s) 1, 3, 5, or 7. The RM-208A in slot 1 is paired with the RM-A/O in slot 2, etc.

2.5.3 Call Origination. For call origination, the RM-8E housing must have a standard RM-800 located in slot 0 and the RM-A/O must be strapped for the ACU mode. Call origination is accomplished by dialing out on the line associated with the appropriate RM-A/O in slot(s) 2, 4, 6, or 8, and establishing a connection with the called party's receive line. Then, dial out on the line associated with the appropriate modem in slot(s) 1, 3, 5, or 7, and establish a connection with the called party's transmit line. After both calls have been established, the RM-A/O connects the modem to the lines, and sends the data mode (DM) signal to the DTE. Call termination is accomplished by dropping the terminal ready (TR) signal to the modem.

2.5.4 Call Answering. The RM-800 is not required for the call answering mode of operation. The RM-A/O is strapped for the answer mode (AAU) and occupies slot(s) 2, 4, 6, or 8 of the RM-8E enclosure. The associated modem is located in slot(s) 1, 3, 5, or 7.

When a ringing signal is detected on either of the two lines, the call is answered, if the terminal ready (TR) input is active. The answer tone generated on the RM-A/O card is transmitted to the calling party. When the second ringing signal is detected (within the preset time limit), the RM-A/O sends a second answer tone to the calling party. After both calls are established, the lines are connected to the modem, and an active data mode (DM) signal is sent to the DTE. If the second call is not received within the preset time of 54 seconds, the RM-A/O terminates the first call and monitors the lines for a new ringing sequence.

NOTE

When the RM-A/O is used, the even numbered TELCO connectors are used (see figure 5-1). If the RM-208A is in slot 1 and the RM-A/O is in slot 2, use TELCO connectors 2 and 2A. Connector 2 will be the transmit pair and connector 2A will be the receive pair of the local modem.

2.6. RM-8E Switching Power Supply. The RM-8E enclosure contains two identical power supply PC cards. The on-line unit is fully loaded and both front panel LED's are illuminated, POWER ON and SUPPLY ON LINE. The voltage outputs of the standby unit are connected to the contacts of an inactive on-card output relay, and the POWER ON LED is illuminated. Each card contains voltage monitor circuits and a detection of any out-of-tolerance output voltage in the on-line power supply initiates the following simultaneous actions: (1) the voltage outputs of the faulty on-line module are disconnected from the enclosure voltage bus by de-energizing its output relay, (2) the standby module outputs are connected to the bus by activating its output relay, and (3) the POWER ON LED of the faulty module begins to flash at an one second interval.

Each module converts the 115 Vac, 60 Hz, nominal input voltage into three DC outputs: (1) +5 Vdc, (2) +12 Vdc and (3) -12 Vdc. The input AC voltage is rectified through a full wave bridge rectifier and switching regulator network. Three series regulator and sensing circuits provide the output voltages to the output relay. A transistor driver energizes the output relay of the on-line power supply.

SECTION III

THEORY OF OPERATION

3.1 RM-8E SYSTEM DESCRIPTION. The RM-8E modem system may be configured in several different patterns as shown in figure 5-3. A system block diagram is given in figure 3-1. The RM-800 manual call unit is always located in enclosure slot 0. The unit allows manual callout on any dial up RM-208A modem. When paired with a RM-A/O, the RM-208A is a 4-wire dial up modem. The operator can manually call out on any dial up modem in the enclosure, using the external exclusion key telephone. The manual call unit decodes the telephone dial pulses and supplies an active modem select enable; the unit also generates talk mode and data mode control outputs.

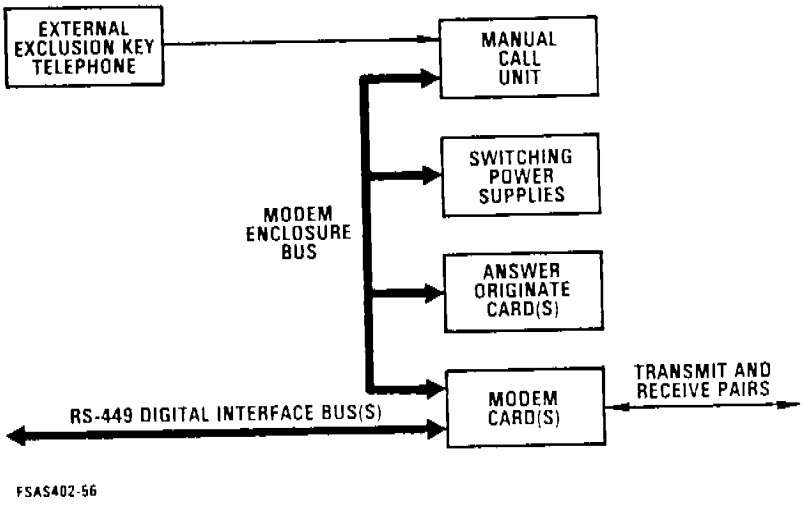

Figure 3-1. RM-8E System Block Diagram

The RM-A/O card changes the RM-208A modem card from a 4-wire private line to a 4-wire dial up. The RM-A/O may be strapped for either call origination or call answering. An answer tone generator output on the RM-A/O card is transmitted to the calling party in the call answering mode.

Depending on the desired configuration, either the RM-208A or the RM-9600 modem(s) may be installed. The RM-208A modem operates at 4800 bps on a 4-wire private line, or on a dial up network when used with the RM-A/O card. If the RM-208A is used on a dial up network, the RM-8E enclosure will accept a maximum of four RM-208A's and four RM-A/O's. The RM-9600 is a 9600 bps modem that operates only on a

4-wire private line. The enclosure accepts a maximum of eight RM-9600 modems. Each modem has edge-mounted switches that allow operator testing. The test modes and operator test procedures are discussed in paragraph 4.3. When both modem test switches are in the "NORMAL" position, the modem is under DTE control and normal data transfer occurs. Each modem is controlled through the standardized RS-449 digital interface bus that provides for the orderly information transfer between the modem and the external DTE.

The RM-8E enclosure contains two switching power supply modules. Only one power supply is on-line, with the other module in a standby mode. Each module has voltage comparison circuits. The modules are cross-coupled to allow either module to assume the load if the voltage comparison circuits detect an out-of-tolerance condition.

3.2 RM-800 MCU CARD. Switch S1 is always open circuited (bus position), and the telephone hand-set provides the MCU inputs. Refer to the MCU block diagram, figure 3-2, and the MCU schematic, figure 6-1. The hook-switch input is a double-sided input which forms a series path with the hook switch in the handset. The switch is open when the receiver is on the hook, and closed when the receiver is lifted off the hook. The closing of the switch provides a voltage path which enables the dial pulse decoder circuit. This voltage is applied to an isolation circuit, and then to the enable input of a binary counter. The telephone dial pulses are applied through an isolation circuit to the count input of the binary counter.

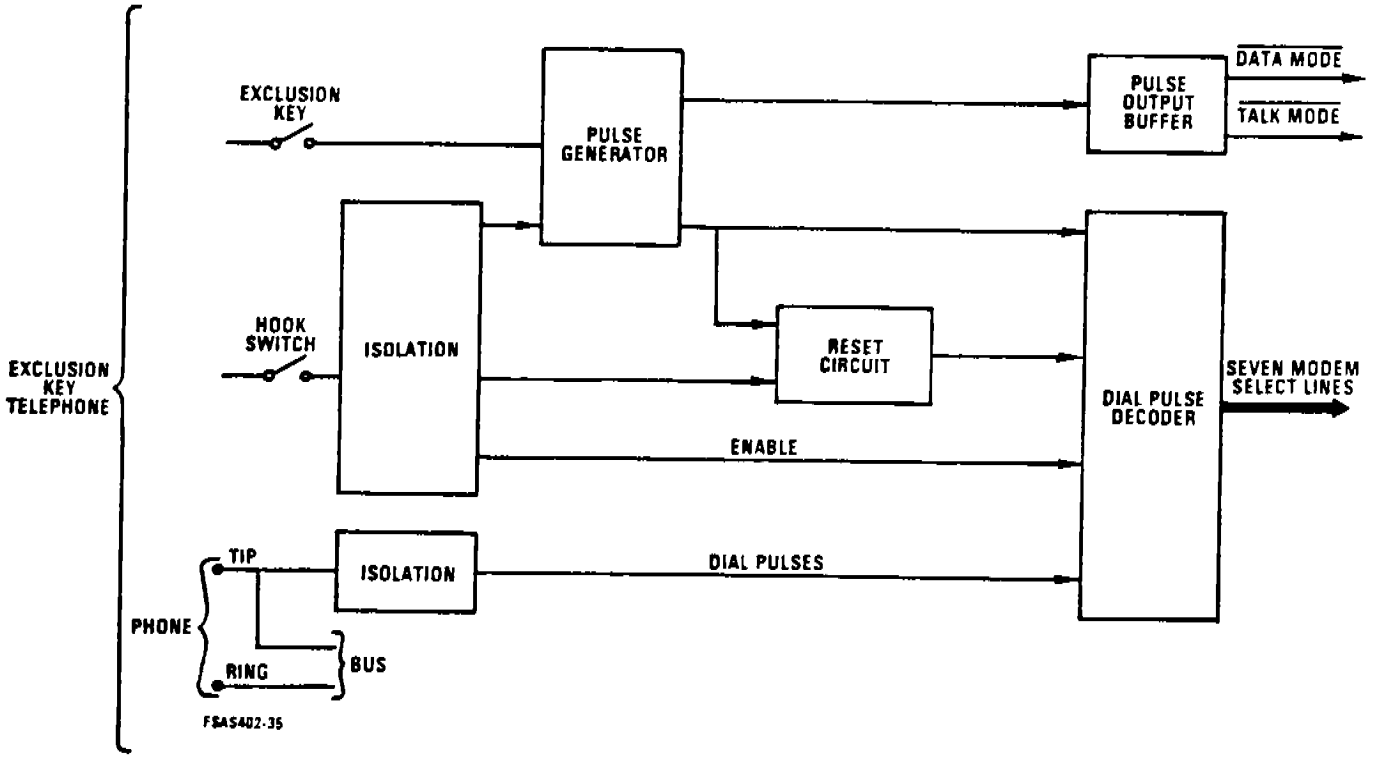

Figure 3-2. RM-800 MCU (Manual Call Unit) Block Diagram

After the slot number has been dialed, the operator raises the exclusion key. This closes a set of contacts in the telephone and applies a positive voltage to a pulse generator circuit. A Talk Mode pulse (negative) is generated and routed to the RM-A/O (answer/originate) card. The pulse generator output is also applied to the clock input of the D-type flip-flops which receives the slot number output of the binary counter via the D input. This latches the dialed slot number into the FF's, and the Q outputs are sent to the decoder-driver circuit.

The slot number is latched on the line select bus, and the selected RM-A/O responds by connecting its communication line to the telephone through the MCU. Once the operator call is completed, the exclusion key is depressed and the Data Mode pulse (negative) is generated for the RM-A/O card. An off hook state is latched on the RM-A/O card on line 1. The telephone releases the line to the RM-A/O when the telephone is hung up.

3.3 RM-A/O CARD.

3.3.1 General. Call origination is allowed when the RM-A/O card is used with the RM-800 MCU and the RM-208A modem. The RM-800 MCU is not required for the call answering mode. In either case, the RM-A/O card occupies slot(s) 2, 4, 6, or 8 and its associated RM-208A modem resides in slot(s) 1, 3, 5, or 7. The RM-A/O jumper configuration is shown in figure 6-3. The RM-A/O is either strapped for call origination (ACU mode) or call answering (AAU mode). The abort timer is strapped for 54 seconds. The RM-A/O terminates the first call if the second call is not received within 54 seconds.

3.3.2 Call Origination. During call origination the RM-800 card decodes the addressed card and initiates control signals to the RM-A/O card. The RM-A/O block diagram and schematic are shown in figures 3-3 and 6-2 respectively; a flow chart for call origination is presented in figure 3-4.

Three initial conditions are required to activate the call origination mode. The DTE must send an active low TR (terminal read). The MCU must transfer the dialed line select address, and initiate a Talk Mode pulse (negative). First, a connection is made with the called party receive line. Active low signals at Line Select 1 and Line Select 2 place a high level at the D input of Z8. The Talk Mode pulse (negative) clocks a positive AD1 level through Z8 pin 13. Q3 is activated and closes relay K2 (AD1). If the operator completes the call, the exclusion key is released on the telephone and generates a Data Mode pulse via the MCU. This pulse clocks a positive output through Z8 pin 1, activating Q4 and closing relay K1 (OH1). The high AD1 output at Z8 pin 13 is reset. Line two is connected in a similar fashion except that both Line Select 3

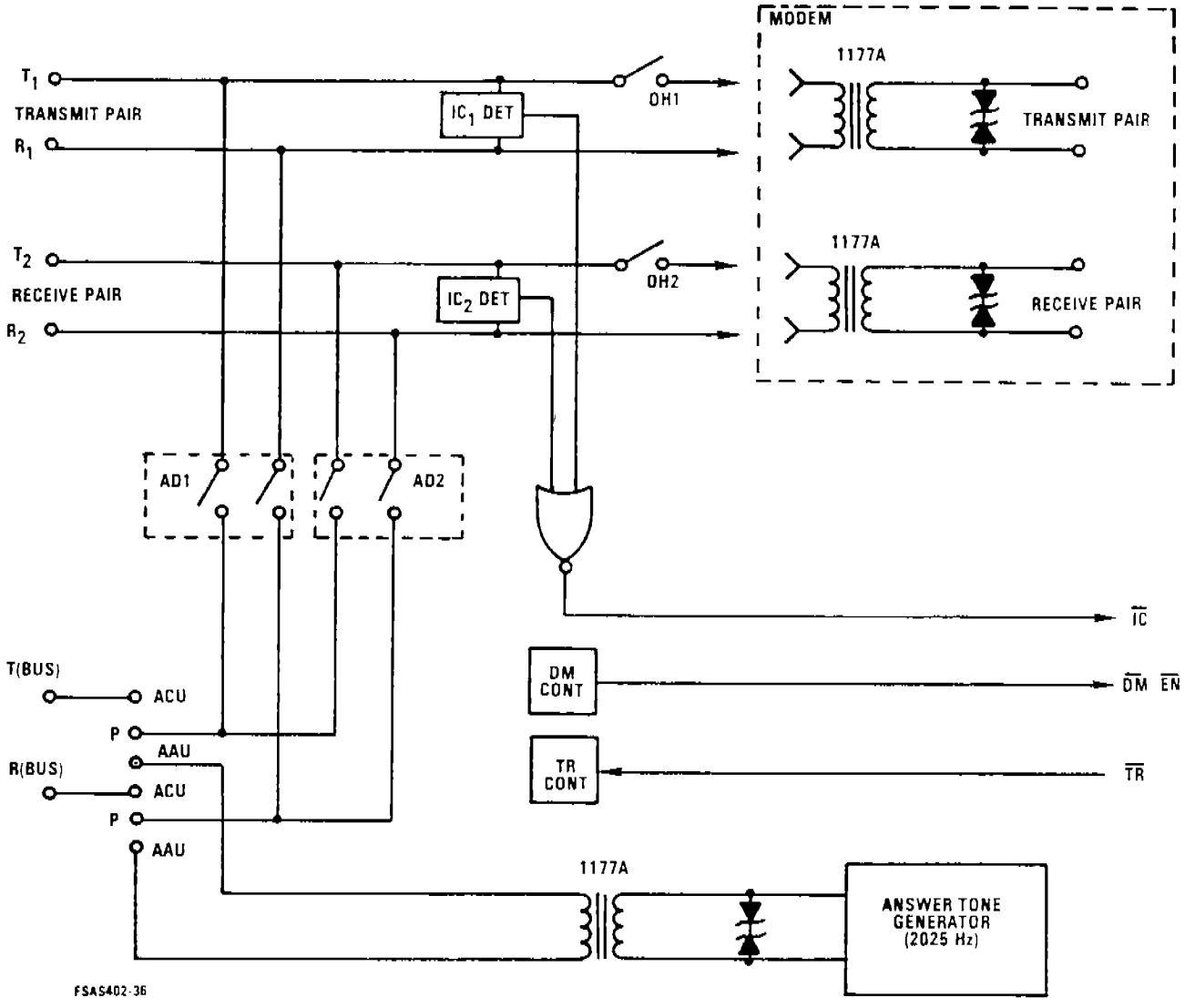

Figure 3-3. RM-A/O Block Diagram

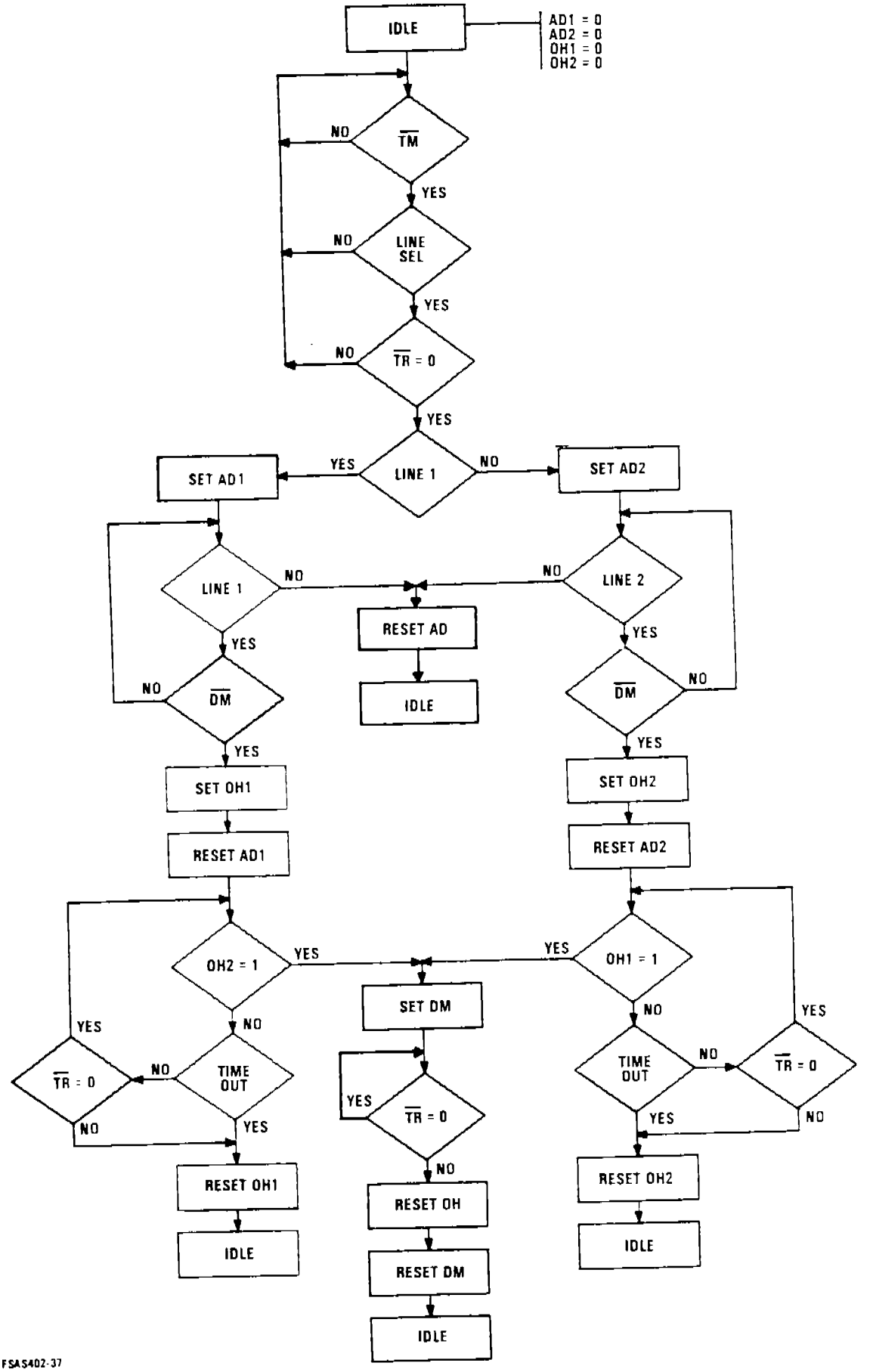

Figure 3-4. RM-A/O Call Origination Flow Chart

and Line Select 4 are active low. With both K1 and K4 relays closed (OH1 and OH2), a positive data mode enable is generated, DM EN. The call is terminated when the TR signal (terminal ready) goes high, or inactive, and resets Z8 and Z10.

3.3.3 Call Answering. A flow chart for the call answering mode is shown in figure 3-5. Refer to the RM-A/O block diagram and schematic as required, figures 3-3 and 6-2 respectively. When a ringing signal is detected on either of the two lines, the call is answered if the TR control input is active low. Incoming Call Detector 1 is composed of optical buffer Z3, comparator Z1, and associated components. The incoming signal is half-wave rectified, filtered, and optically coupled by the Z3 circuitry. During ringing, the positive current flow through D1 and R4 triggers a negative going pulse from Z1. The pulse is inverted through Z11 and clocks a positive AD1 signal from Z8. This sets the AD1 relay and removes the active high reset at Z5 via Z7. Z5 is clocked at a 9.375 Hz rate. After a period of 2.5 seconds, the ABT output of Z21 goes low and removes the Z19 reset. During the next 2.5 seconds, the answer tone generator circuit supplies an output frequency of 2025 Hz as shown in figure 3-6.

The answer tone generator circuit is composed of the following major components: the 4.9152 MHz oscillator, divide-by-four flip-flop Z13, dual counter chips Z15 and Z17, and the 8-channel analog multiplexer Z19. The Q0 output of Z15 is gated through Z16 and clocks the first stage of Z17. The Z18 exclusive-OR gates code the Z17 Q outputs into the Z19 octal select values shown in figure 3-6. During the period that Z17 Q7 is high, +12 Vdc is supplied to the Z19 input resistor network. Output amplifier Z20 and transformer T1 couple the answer tone through the closed contacts of relay K2 (AD1). After a 2.5 second answer tone duration, the ABT signal goes high at Z21 pin 6. The positive going ABT pulse generates the following actions: (1) inhibits the output of Z19, (2) clocks out a positive OH1 level through Z8 that sets the OH1 relay, (3) resets the AD1 output of Z8 pin 13 via the active OH1 level gated through Z7 and Z9, (4) removes the idle reset state of Z4 with the active OH1 level gated through Z18 and Z16, and (5) resets the Z5 answer tone timer via the inactive AD1 level gated through Z7.

Once Z5 is reset, the Z21 ABT output remains high until the second call initiates a high level AD2 period. If the second call is not received within the preset time of 54 seconds, Z4 will time out and reset the card components to the idle state. Incoming Call 2 is conditioned by the Z2 and Z1 circuits. The circuit operation is identical to the IC1 input except that signals are generated to set relays AD2 and OH2, and then reset AD2. After relays OH1 and OH2 are set, the DM EN (data mode enable) output is gated high through Z7 pin 10. The call answering mode is terminated when the TR (terminal ready) signal goes high at Z12 pin 2.

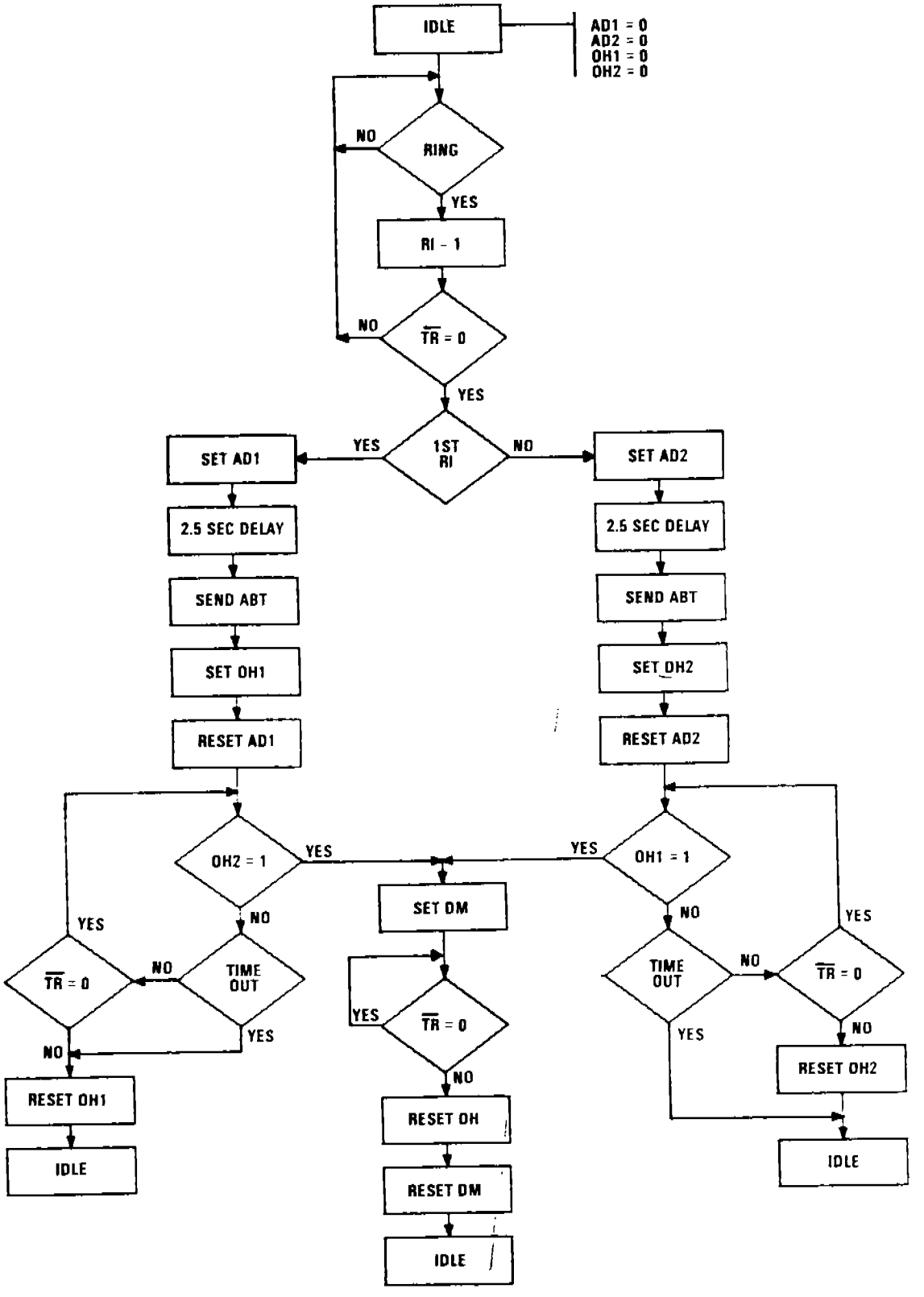

Figure 3-5. RM-A/O Call Answering Flow Chart

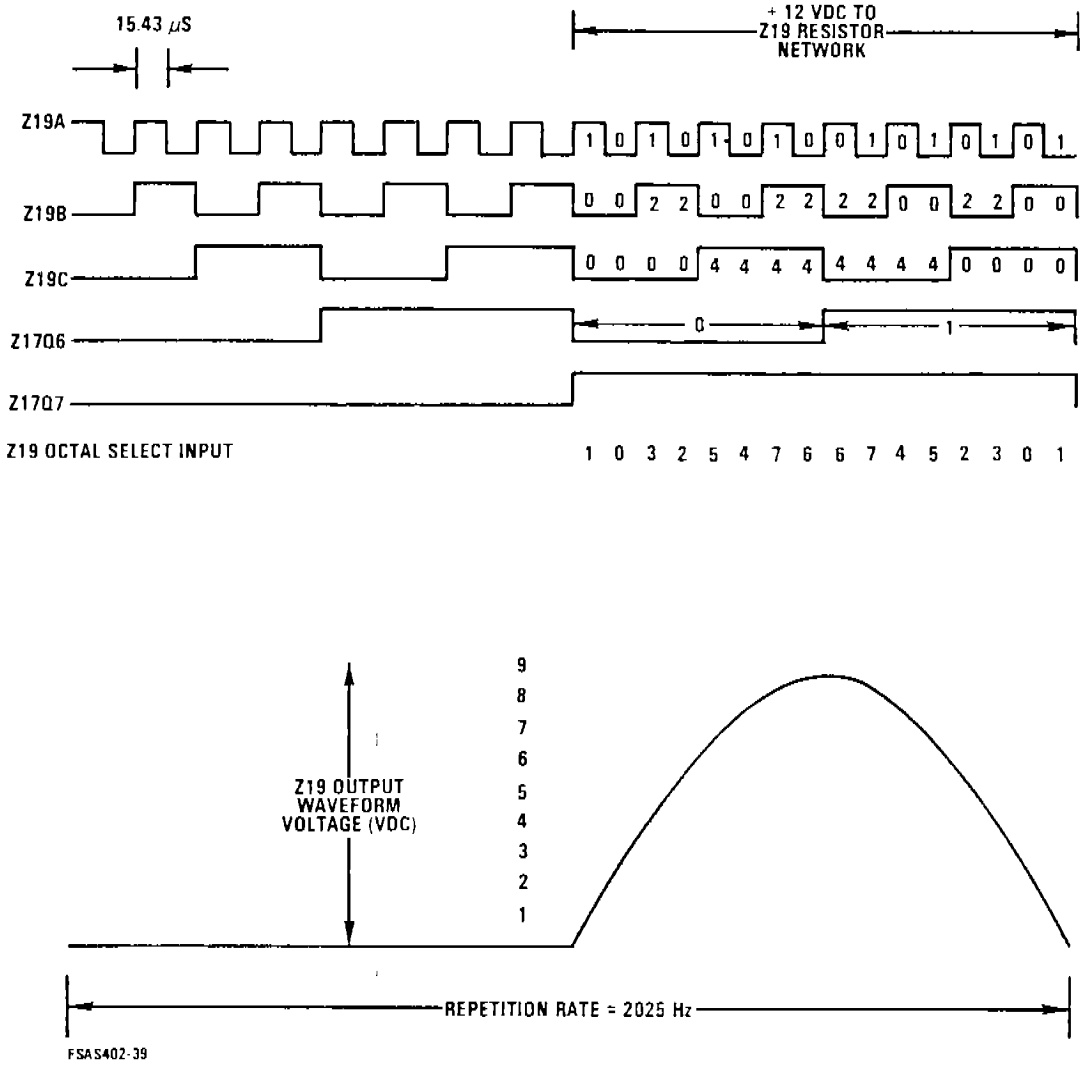

Figure 3-6. Answer Tone Generator Output Frequency

3.4 RM-208A MODEM CARD.

3.4.1 Jumper Configuration. The jumper configuration for the RM-208A modem card is identified in figure 6-5. The Request To Send control (RS) is strapped in the ON state for constant carrier operation. A 50 millisecond delay is selected for the Clear to Send (CS) delay timing. This option requires two straps. The Data Mode (DM) option controls the state of the DM output during Analog or Digital loopback modem tests. The DM output is strapped OFF during these test modes. The modem supplies a 4800 hertz clock (Send Timing A) to the DTE via the jumper selection for internal transmit clock.

Digital pre-equalization is selected and analog pre-equalization is jumpered inactive. Because the minimum receive level is greater than -44 dBM, the -34 dBM detect level is strapped. This allows a greater background noise level and reduces the probability of a false carrier level indication. The initial transmit level is jumpered at -10 dBM but is adjusted for the optimum interface level. The Signal Quality Retrain option is strapped ON. This causes the automatic equalizer to initiate a retrain cycle to re-establish its tap gain values when the equivalent signal-to-noise ratio drops to approximately 12 dB. The Signal Common (SC) is strapped out which separates the SC from the DTE SC; the new sync option is disabled. Four-wire operation is enabled via the four-wire jumper.

3.4.2 Block Diagram Description. The RM-208A is a 4800 bps modem that may be used in a 4-wire full-duplex configuration, or used in a dial up network (DDD) when configured with the RM-A/O card. A block diagram and schematic of the RM-208A are shown in figures 3-7 and 6-4 respectively. Refer to both figures for the following block diagram and signal flow analysis. The block diagram in figure 3-7 reflects the normal operational mode of the RM-208A modem. The test modes and operator test options are presented in paragraph 4.3 with accompanying block diagrams.

The RM-208A card supplies both transmit and receive clocks. A 7.3728 MHZ oscillator (Y1) provides the clock input for the programmable bus port (Z47). The port provides a MCLK output of 3.6864 MHZ that drives the synchronous counters and other logic chips. The MCLK clock is divided into a 4800 HZ transmit clock by the following counters and flip-flops Z54, Z68, Z66, and Z74. The 4800 HZ output is buffered by Z82. The receive clock supplied by the modem is in sync with the received data, and is generated through the following chips: Z54, Z42, Z67, Z84, and Z73. The receive clock is routed through multiplexer Z60 and buffered by Z81. In addition to generating the transmit and receive clocks, the synchronous counters supply a variety of clock frequencies to other logic chips.

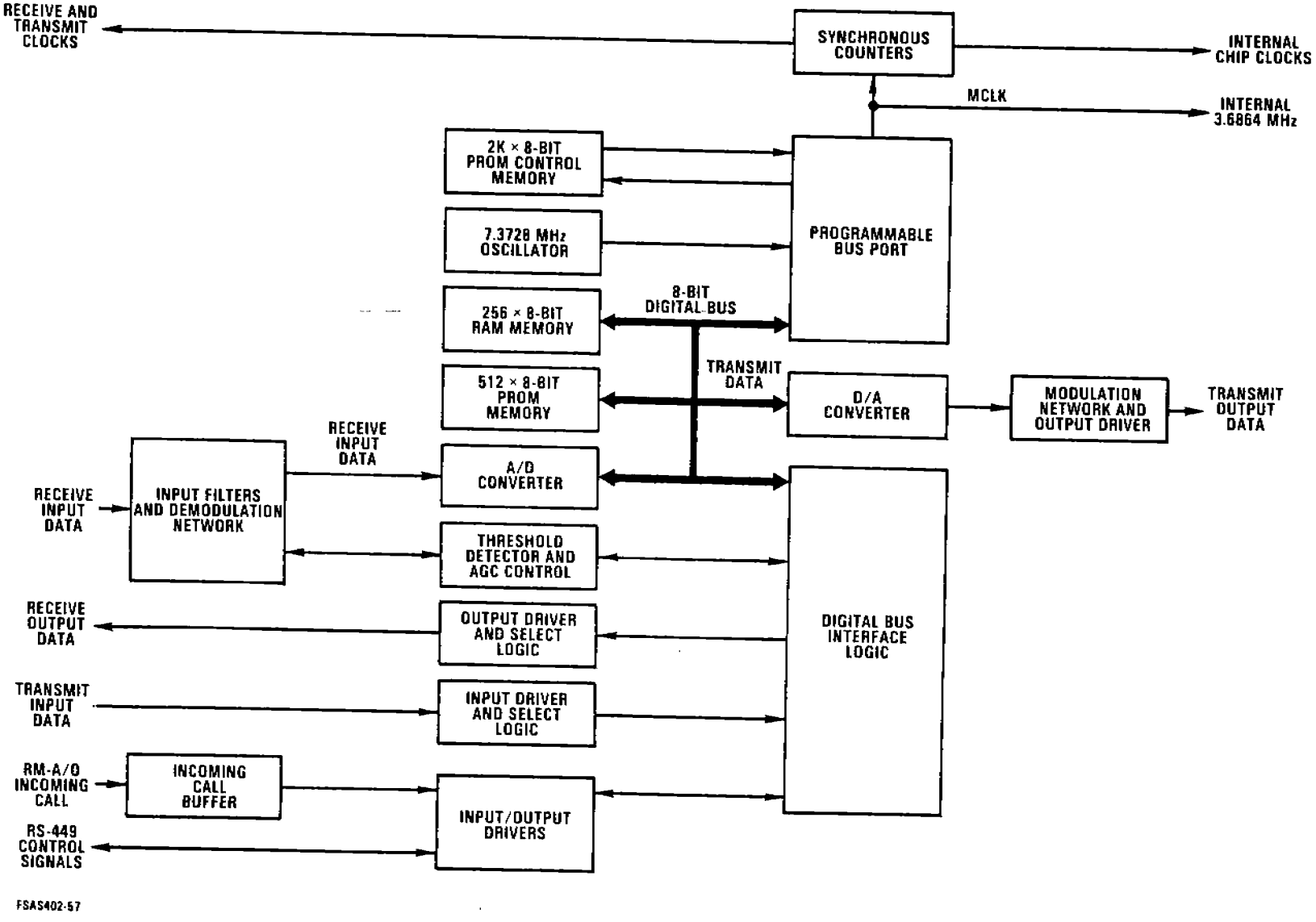

Figure 3-7. RM-208A Modem Card Block Diagram

The programmable bus port (Z47) is the interface device for the software instructions contained in PROMS Z78, Z79, and Z77. Z78 and Z79 contain 2K X 8-bits of PROM control memory. These PROMS are addressed by the outputs of Z47, A3 through A12. The addressed software is executed through the PROM outputs supplied to Z47 input terminals IO through I15. Z47 is interfaced to the 8-bit digital bus via terminals BO through B7. PROM Z77 is addressed from the 8-bit digital bus through octal flip-flop Z56. The addressed PROM output is enabled when the Z77 chip enable inputs are active, $\overline{CE1}$ and CE2 low, CE3 and CE4 high. RAM chips Z57 and Z58 provide 256 X 8-bits of memory, and are connected to the 8-bit digital bus via the chip I/O ports. The PROM software, RAM storage, and 2's complement multiplier (Z59) largely generate the transmitter pattern (scrambler) and receiver demodulation descrambler processes, both for normal operation and test modes.

The transmit input data is buffered by input driver Z49 and switched through multiplexer Z48 to the octal D-type F/F, Z35. The serial data is clocked through Z35 at a rate of 4800 HZ to the B6 line of the 8-bit digital bus. The input data is digitally modulated and clocked through Z28 to the D/A converter, Z27. The analog transmit data (TXA) is routed to the modulation network and output driver. The compensation amplifier network Z10 supplies the data output to analog switch Z8. The SCT timing pulses are summed with the data output at Z8 and switched to the output driver Z6. The transmit data is coupled through transformer T1 with the output level jumpered for the optimum operating condition.

The input receive data is coupled through transformer T2, and switched through analog switch Z7 to the input buffer Z5. The buffered receive data is routed to a series of cascaded filter circuits, Z4, Z5, Z3, and Z24. At this point the threshold detector and AGC control circuitry monitor the input level of the filtered receive data. The AGC control is activated by a low AGCC signal that is latched through Z29, a bus interface logic chip. Inverter Z64 supplies a high AGCC level to analog switch Z62 removing the negative bias feedback through R128. Once the threshold level of -34 dB is reached, the threshold detector Z22 suplies a high logic level through Z63, activating the remaining Z62 analog switch sections. The level of the filtered receive data is conditioned through amplifiers Z36 and Z9, providing a bias control on the SW3 (FET) gate. Thus, the AGC control is implemented by regulating the current flow through SW3, which controls the voltage level of the filtered receive data at the Z9 non-inverting input. The threshold level detection at -34 dBm is monitored by the RLSD signal, through Z63 and Z64, and supplied to the 8-bit digital bus via Z31.

The filtered receive data under AGC control is routed from Z9, through the Z22 1800 HZ filter circuit, to the demodulation circuitry. A CLTNK clock level is established through circuits Z38,

Z23, Z36, and Z63. CLTNK is clocked through Z52 and supplies the clock pulse input for Z32, an octal bus interface latch. The demodulated analog receive data is clocked through analog switch Z51 to Z71. The Z83 A/D converter supplies a digital output through Z30 to the 8-bit digital bus. The data is decoded and a receive serial output is clocked through Z86. The receive output is selected through multiplexer Z60 and supplied to output buffer Z82.

The RS-449 control signals are buffered by input and output drivers, and are largely connected to the card bus via the bus interface logic chips. The RM-A/O incoming call signal is buffered by Z18 and Z21, and supplied to the RS-449 bus. Table 5-1 lists the active pin connections for the digital RS-449 interface bus.

3.5 RM-9600 MODEM CARD.

3.5.1 Jumper Configuration. The jumper configuration for the RM-9600 modem card is identified in figure 6-7. The Clear To Send signal is active at the end of the synchronization sequence, producing a Clear To Send delay of approximately 253 milliseconds. The Data Mode signal output is strapped ON during an Analog Loopback test. The modem supplies a 9600 hertz, internal bit rate clock to the external DTE (Send Timing A). During a Digital Loopback test, the modem also generates the receive clock.

The Pre-Equalizer circuitry is strapped OFF. The receiver equalizer is connected to the T/2 position, allowing the equalizer to operate over a 16 baud timer. The modem carrier transmit output is strapped continuously ON and the receiver carrier detect level is jumpered for -26 dBm. An averaged input error rate is generated by the receiver decision logic, and is monitored via the control processor. When the error level reaches a bit error rate of approximately 1×10^{-4} for a duration of three seconds, the processor initiates an outbound train sequence, using the signal quality retrain strap enable. The external modem then responds with a signal training sequence that retrains the local RM-9600 modem.

The fallback rate option is not used, and the fallback switch located on the front edge of the card is disabled. An initial transmit output level is jumpered for -12 dBm but is adjusted for the optimum interface level. The signal common option is strapped ON and connects the modem signal common to the external DTE.

3.5.2 Block Diagram Description. The RM-9600 is a 9600 bps modem that operates only on a 4-wire leased line. A block diagram and schematic of the RM-9600 are shown in figures 3-8 and 6-6,

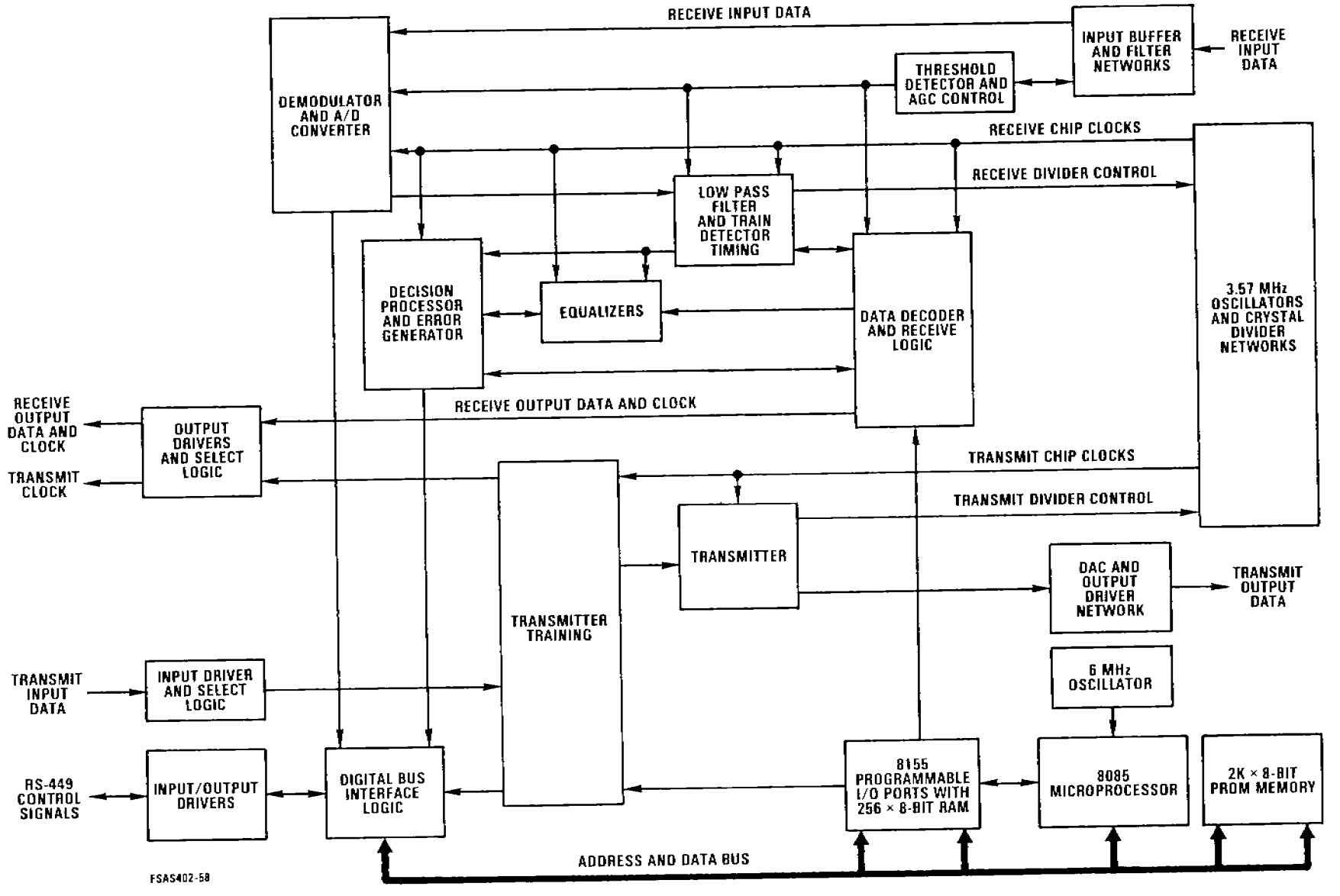

Figure 3-8. RM-9600 Modem Card Block Diagram

respectively. Refer to both figures for the following block diagram and signal flow analysis. The RM-9600 block diagram reflects the normal operational mode. The test modes and operator test options are explained in paragraph 4.3 with accompanying block diagrams.

The RM-9600 modem contains a 8085 microprocessor system with an accompanying 8155 chip(256 X 8-bits of RAM memory and programmable I/O ports). The 6 MHz oscillator drives the clock input for the 8085 microprocessor. The microprocessor supplies a 3 MHz clock output that is divided by 20 via Z35 and Z36. The 150 KHZ clock output drives the 8155 timer input. The other clocks required for the transmit and receive processing chips are generated by the 3.57 MHz oscillators and crystal divider networks, Z21 and Z23. Z21 provides clock outputs to the following functional areas: (1) Decision processor and error generation, (2) Demodulator and A/D converter, (3) Data decoder and receive logic, and (4) Low pass filter and train detector timing. Clock inputs for the transmitter and transmitter training are generated through Z23. The receive and transmit divider control signals for Z21 and Z23 are supplied by the low-pass filter and train detection timing, and the transmitter, respectively.

The functional circuitry for the 8085 microprocessor and related components are interconnected by a common address and data bus. The microprocessor (Z37) is a 8-bit parallel central processing unit with a multiplexed data bus. The least significant 8-bits of the address is shared with the 8-bit data bus (AD0-AD7). The address lines utilized on the most significant 8-bits include A8, A9, A10, A13, A14, and A15. The basic clock speed of Z37 is 3 MHz. During the first clock cycle of a Z37 machine cycle, the low order address is connected to the address/data bus. These lower 8-bits may be latched externally by the address latch enable (ALE). During the remainder of the machine cycle, the data bus is used for memory or I/O data.

Z37 provides three signals for bus control: read control (RD), write control (WR), and machine cycle status (IO/M). A low level on RD indicates the selected memory or I/O device is to be read, and that the data bus is available for the data transfer. A low level on WR indicates the data on the data bus is to be written into the selected memory or I/O location. The data is set up on the trailing edge of WR (low). The IO/M signal supplies the machine cycle status, i.e., memory/IO read/write, opcode fetch, and interrupt. Three Z37 control inputs are not used and are connected to signal ground, the inactive state. These signals include hold request (HOLD), interrupt request (INTR), and trap interrupt (TRAP).

Three restart interrupt inputs are processed by Z37. These inputs initiate an internal RESTART to be automatically inserted. The priority of these interrupts is: (1) RST 7.5, (2) RST 6.5, and (3) RST 5.5. The rising edge of RST 7.5 is latched; the other two interrupts remain high until sampled by Z37. The serial output data line is used to control the preset function of Z35. The ready control input (READY) is tied high, the active state. Z34 provides the reset signal to Z35, active low. A power on reset and a switch (S3) triggered reset are supplied for the microprocessor. The active low reset input sets the Z37 internal program counter to zero and resets the interrupt enable. Data, address, and control lines are set to the high impedance state during the reset period. The reset output of Z37 (RESET OUT) is active high during the reset period, and synchronized to the microprocessor clock. The reset output resets Z38, and sets the Z48 outputs to the high impedance state.

The 8155 chip (Z38) contains a 256 X 8-bit static MOS RAM, three programmable I/O ports, and a programmable 14-bit timer. Z38 has a 8-bit multiplexed address/data port, AD0-AD7. The 3-state address/data lines interface with the Z37 lower 8-bit address/data port. The input address for Z38 is latched inside the chip on the falling edge of ALE. The address can be either for the Z38 RAM memory, or I/O section depending on the IO/M input state. The 8-bit data is either written into the chip or read from the chip, depending on the WR or RD input states (both active low). The programmable I/O ports (A, B, and C) function under the control of an internal command register that decodes the opcode instructions. The Z38 chip enable (CE) is active low; the enable is supplied by an inverted Z37 A15 output through Z55. A low input on the read control line with an active chip enable activates the Z38 address/data buffers. If the IO/M input is low, the addressed RAM data is transferred to the address/data (AD) bus. If IO/M is high, the addressed I/O port or command/status register data is transferred to the AD bus. If the write control input is low, the AD data is written into RAM, or transferred to the addressed I/O port, or command/status register, depending on the IO/M state. The timer input is 150 KHz, counted down from the Z37 3 MHz clock output. The timer output supplies a RST 7.5 interrupt to the Z37 microprocessor, under opcode control. The reset pulse is supplied from Z37 and initializes the 8155 system.

The opcode for the microprocessor system is stored in Z51, a 2K X 8-bit PROM. The chip and output enables are both active low, supplied by Z37 A15 and MEMR, respectively. The chip is addressed through the A0 through A10 inputs, and the opcode instructions are supplied to the AD bus.

The digital bus interface logic connects the microprocessor system to related RM-9600 processing chips. The Z50 octal latch transfers address bits A0 through A7. When the ALE latch enable is high, data from the AD bus enters the Z50 latches (latches are transparent in this state). When ALE is low, the input data is latched that was present during the setup time preceding the high-to-low ALE transition. The Z49 octal latch output is enabled via the Z37 microprocessor and transfers control signals and fixed jumper levels to the AD bus.

The EQM data output from the Z22 demodulator and A/D converter is shifted through Z47, and latched through Z48 to the AD bus. Z47 is clocked by the D12CKP clock from Z22. The clock input is gate enabled by the EQM signal gate from the Z20 decision processor and error generator. This signal gate is inverted and clocks the latch enable input for Z48. The I/O control signals on the RS-449 bus are largely interfaced to the AD digital bus by multiplexers Z40 and Z53, quad differential input receiver Z66, and output drivers Z61 through Z64.

The receive input data is coupled through transformer T1 and input buffer Z8A, to the Z8B high pass filter. At this point the receive input is connected to two circuits: the S4(FET) AGC level control and the Z3 threshold detector, jumpered for -26 dBm detect level. Once the minimum threshold level is surpassed, two sections of the Z4, triple 2-channel, analog switch are enabled, activating the AGC circuit. Under opcode control, a AGC FAST command from Z38 will enable the third Z4 switch section. The threshold level detect signal also activates a Z59 switch section and shorts the inputs to Z2. Here, the threshold level detect signal is supplied to the data decoder and receive logic chip, Z13, the demodulator and A/D converter, Z22, and the low pass filter and train detector timing, Z19. The conditioned signal is identified as the receive line signal detect input. The amplitude of the receive input data signal is controlled by the AGC feedback bias applied to the gate of S4. The S4 output voltage is buffered through Z5 and supplied to the low pass filter networks, Z24 and Z30A. Then, the receive signal is amplified through Z30B, buffered via Z31, and provided to the IANALOG input of the Z22 demodulator and A/D converter.

The Z22 chip interfaces with the other receive processing circuits and supplies three basic receive functions: carrier detection, demodulation, and analog-to-digital conversion. A demodulator data output supplies the MDMP input to Z19, the low pass filter and train detector timing chip. EQM data and demodulator carrier phase signal inputs to Z22 are generated by the Z20 decision processor and error generator. The Z22 EQM serial data output is shifted through Z47 and latched through Z48 to the AD bus. Z22 supplies the shift register clock via the D12CKP clock output. The A/D output of Z22

provides 7-bit parallel data plus a sign bit. The Z22 A/D output is D/A converted by Z33, and summed with the Z31 output (DSAMHO). The summed DECP output signal is returned to Z22 via the I2DECP input.

A low pass filter and train detector timing are supplied by Z19, a receiver processing chip. The receive line signal detect input to Z19 is generated through the threshold detector circuit; the signal is active when the input receive level exceeds -26 dBm. Demodulated serial data is supplied to Z19 from the Z22 demodulator and A/D converter chip. The Z13 data decoder and receive logic unit supplies a multiplexed serial data input. The Z19 clock inputs are generated through crystal divider Z21, with the divider control signal (CCCRX) supplied via Z19. The Z19 low pass filter (LPF) provides two outputs, serial data out and a delayed serial data out. The serial data out is provided to the Z20 decision processor and error generator, identified as carrier phase and detect data. The serial data out also drives the Z9 data input (equalizer No. 1). The LPF delayed output is routed to equalizer No. 2, Z10. The period 1 detect and period 2 detect output signals provide timing inputs to Z13. Z19 generates a system sync pulse for the following receive processing chips: equalizers, Z13, Z20, and Z22.

The Z20 decision processor and error generator supplies four basic receive functions: decision processor data, carrier recovery, error generation, and EQM data. Z21 generates common clock inputs for Z13, Z22, Z20, Z19, and equalizers Z9 through Z12. The Z20 EQM calculation select is tied high, enabling magnitude and phase data calculations. A system sync and carrier phase detect data are supplied via Z19. The Z13 data decoder and receive logic chip generates two multiplexed data signals for Z20, RLC1 and RLC2. Four pairs of real and imaginary equalizer partial products are supplied to Z20 by equalizers Z9 through Z12. Z20 generates real and imaginary scaled error inputs (plus sign) for each equalizer. The decision data signal is supplied to the decision logic of Z13. The demodulated carrier phase and EQM data are provided to Z22. The EQM signal gate enables the Z45 clock gate, allowing the Z22 EQM data output to be shifted through Z47.

The four equalizers (Z9-Z12) are serially cascaded into one unit with common clock inputs generated by Z21. The equalizers together with Z13, Z19, and Z20 implement a 32 tap non-recursive digital filter that provides the automatic adaptive receiver equalizer function. At Z13, the receiver equalizer strap is connected for the T/2 mode position that allows equalizer operation over a 16 baud timer. Z13 generates three common control signals for each equalizer: T/2 mode, reset coefficients to zero, and train mode control. Other Z13 control inputs include the following inhibit commands: (1) inhibit update for C0-C7 coefficients at Z9, (2) inhibit update for C8-C15 coefficients at Z10, and (3) inhibit

update for C16-C31 coefficients at Z11 and Z12. A common active enable for the coefficient update is tied to -12 Vdc for each equalizer. Loading of external coefficients is disabled for each equalizer via the -12 Vdc terminal connection. At Z9, the terminals for loading external coefficients are grounded. The real and imaginary scaled error inputs (plus sign) are generated at Z20 and supplied to each equalizer.

The serial data inputs for the cascaded equalizers are the LPF serial data output of Z19, supplied to Z9, and the delayed LPF output provided to Z10. The data is cascaded through the equalizer units in the following pattern: (1) Z9 serial data output drives the serial data inputs to Z10 and Z11 (delayed), (2) Z10 serial data output supplies the serial data inputs to Z11 and Z12 (delayed), and (3) Z11 serial data output provides the serial data input to Z12. The real and imaginary equalizer signal components are also cascaded within the system: Z9 to Z10, Z10 to Z11, and Z11 to Z12. Each equalizer generates a pair of real and imaginary partial product outputs that are supplied to the Z20 decision processor and error generator.

The Z13 data decoder and receive logic chip provides five basic receive functions: decision logic decoder, train control, signal ROM, data decoder, and de-scrambler logic. Crystal divider Z21 supplies the clock inputs to Z13. The system sync pulse, period 1 detect, and period 2 detect input signals are provided via Z19. Decision data generated in the Z20 decision processor provides the decision data logic input for Z13. The first train input is supplied from the Q output of Z35. Comparator Z60 located in the threshold detector circuit generates the receive line signal detect input. The Z13 receive configuration is determined via the following two inputs: a normal strap for train sequence select and the Z38 baud rate input. Z38 also provides inputs that select the receive data structure and de-scramble code. The receiver equalizer strap is connected for the T/2 mode.

Z13 generates three control outputs for each equalizer chip, Z9 through Z12: T/2 mode, reset coefficients to zero, and train mode control. Other outputs to the equalizers include the following inhibit update commands: C0-C7 coefficients for Z9, C8-C15 coefficients for Z10, and C16-C31 coefficients for Z11 and Z12. Z13 supplies RLC1 and RLC2 multiplexed data to the Z20 decision processor and error generator. Multiplexed data is also provided to the Z19 low pass filter and train detector timing. The train mode detect output is inverted by Z39 and clocks Z35. The Z13 receive output data is inverted by Z55, gated through Z52, selected through multiplexer Z53, and buffered by output driver Z63. The Z13 receive output data clock is inverted by Z55, selected through multiplexer Z53, and buffered by output driver Z64.

The transmit processing section consists of the transmitter training chip Z24, transmitter Z25, DAC network Z26, and associated components. The input transmit data is buffered by Z66, gated through Z58, inverted by Z55, selected through Z53, and connected to the Z24 transmit data input. Z24 provides four basic transmit functions: scrambler, data encoder, train sequence generator, and signal ROM. Crystal divider Z23 supplies the clock inputs to Z24. Z38 generates four types of control signals for Z24: transmit enable, train initialization, transmit data structure, and baud rate. The input patterns for transmit configuration and scrambler select are set by strapping connections and the Z38 baud rate input.

Z24 generates three types of signal outputs: Clear-To-Send, transmit clock, and a 7-bit parallel data format. The Clear-To-Send output is gated through Z52. The active low CTS' signal enables Z58 to transfer the external transmit data. The transmit clock output is supplied to the Z25 transmitter, and to the DTE via inverter Z57, and buffer Z62. The 7-bit parallel encoded data is transferred directly to Z25.

The Z25 transmitter receives clock inputs from crystal divider Z23. Z23 receives the divider control input from Z25 . Z24 generates both the transmit clock and the 7-bit parallel encoded data inputs to Z25. In the transmit mode, the DTE transmit clock input is tied to +5 Vdc through multiplexer Z53. Z25 generates a 7-bit parallel data output (plus sign), formatted in 2's compliment and supplied to the DAC network, Z26. The DAC analog output is routed through the transmit filter network, Z14A, Z14B, Z15A, and Z15B. The transmit output data is buffered by Z17, and coupled through transformer T2. The output level is jumpered for the optimum operating condition.

3.6 RM-8E SWITCHING POWER SUPPLY. The RM-8E enclosure has two power supply modules. Each is capable of providing power to the entire enclosure load of eight modem cards and one MCU card. Only one of the power supply modules is providing power to the modems at any time, and the other module is in a standby mode. The modules are identical; a block diagram of a power supply module is shown in figure 3-9. The schematic is given in figure 6-8.

Each power supply converts 115 Vac, 60 Hz, input power into +5 Vdc, +12 Vdc, and -12 Vdc outputs. The 60 Hz input is full-wave rectified, filtered, and applied to the center tap of the T1 primary. Each end of the T1 primary winding is connected to a transistor, and these transistors are driven by the switching regulator IC. The transformer secondary output is also full-wave rectified with outputs of +20 Vdc, ground (center tap), and -20 Vdc. The +20 Vdc is applied to series regulating circuits to produce final outputs of +5 Vdc and +12 Vdc. The -20 Vdc is applied

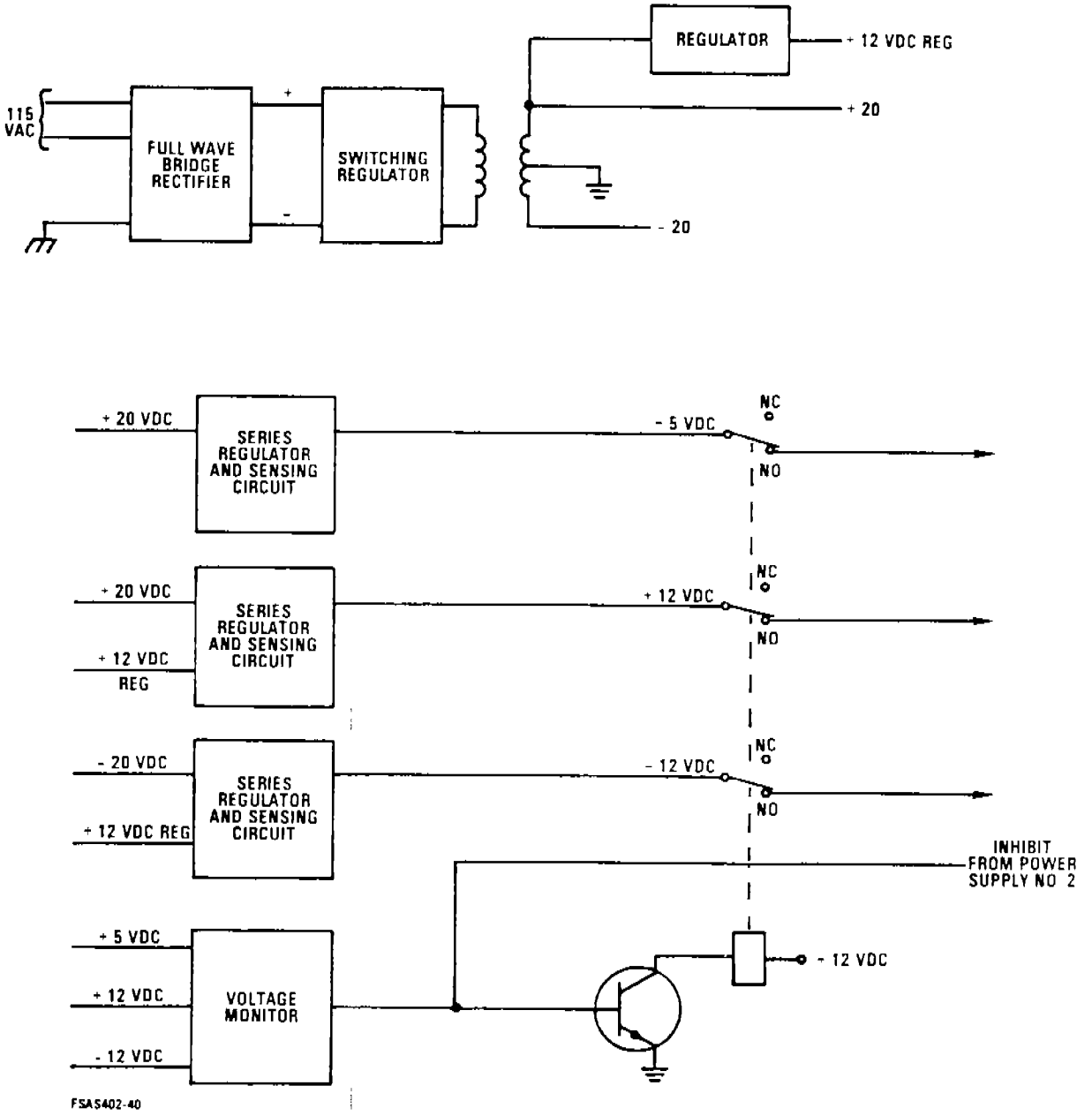

Figure 3-9. RM-8E Switching Power Supply Block Diagram

to a series regulator, and produces a -12 Vdc output. Each of the output voltages is monitored for an over and under voltage condition. If any voltage is out of tolerance, the output relays are deactivated on the operating module. The standby module outputs are then connected to the modem enclosure power bus. The POWER ON light on the disabled module will flash at a 1 second interval.

SECTION IV

MAINTENANCE AND OPERATOR SELF TEST

4.1 MODEM PC CARD MAINTENANCE. A failed modem PC card should be replaced. Since the power supply modules are fully current limited, the enclosure power does not have to be turned off for a modem PC card interchange, thus allowing normal operation of all other enclosure cards. However, if a short circuit is indicated, refer to CAUTION, paragraph 4.2.1.

4.1.1 Modem PC Card Replacement. A failed modem card should be replaced only by qualified personnel, using the following procedures:

a. Turn the enclosure finger latches and open the hinged front panel.

b. The modem card may be removed by pulling on the card extractor and sliding the modem card out through the front of the rack.

c. Install the modem card by sliding it into the card guide, with the card extractor on the bottom. Push the modem card into the connector receptacle located in the rear of the unit, and press the card extractor against the front of the card.

d. Close the hinged front panel and lock it in place by turning the finger latches.

4.2 POWER SUPPLY MODULE MAINTENANCE. A detection of an out-of-tolerance voltage condition causes the faulty on-line module to be disconnected, and the standby module to be substituted. An out-of-tolerance voltage condition initiates a failure indication through the POWER ON LED; the indicator begins to flash at a one-second interval. An inoperative power supply module should be replaced.

4.2.1 Power Supply Module Replacement.

CAUTION

The dual power supply modules are designed for one to be fully loaded and the other in "standby." If both modules are inoperative, check the enclosure and PC cards for a short circuit before replacing the modules. Remove all PC cards, one at a time, until the short is removed. Failure to remove a short will result in possible damage to the modules or back plane wiring.

The power supplies are enclosed in a perforated metal housing covering hazardous ac voltages. Do not attempt to operate with the cover removed. The power supply connector within the enclosure contains 115 Vac power. Do not touch the connector fingers when the unit is connected to ac power.

A faulty power supply should be replaced only by qualified personnel, using the following procedures:

a. REMOVAL

1. Turn the enclosure finger latches and open the hinged front panel.

2. Grasp the module extractor and slide the module through the front of the enclosure.

b. REPLACEMENT

1. Position the module in the guide strips and slide it into the power cage, forcing the module extractor firmly against the front of module.

2. Close the front panel and lock it in place by turning the finger latches.

4.3 OPERATOR SELF TEST MODES. Each plug-in modem has edge-mounted switches which allow operator testing. When both test switches are in the "NORMAL" position, the modem is under DTE control and normal data transfer takes place. The various test modes are described in the following paragraphs.

NOTE

The RM-208A TR LED (terminal ready) is only valid when the RM-208A is used in conjunction with the RM-A/O card.

4.3.1 RM-208A Self Tests.

4.3.1.1 Analog Loopback. Set the St/STRO (Self Test/Self Test Receive Only) switch to NORM. Then, set the AL/DL (Analog Loopback/Digital Loopback) switch to AL. The RM-208A circuit configuration for the Analog Loopback (AL) Test is shown in figure 4-1. The transmitter output is looped into the receiver input. The analog received data is connected to the analog transmit line through a buffer amplifier. All digital interface lines are active. The Data Mode (DM) line is strapped OFF on the RM-208A card during the AL test. The status of the LED indicators is the same as normal operation (refer to paragraph 2.3.1).

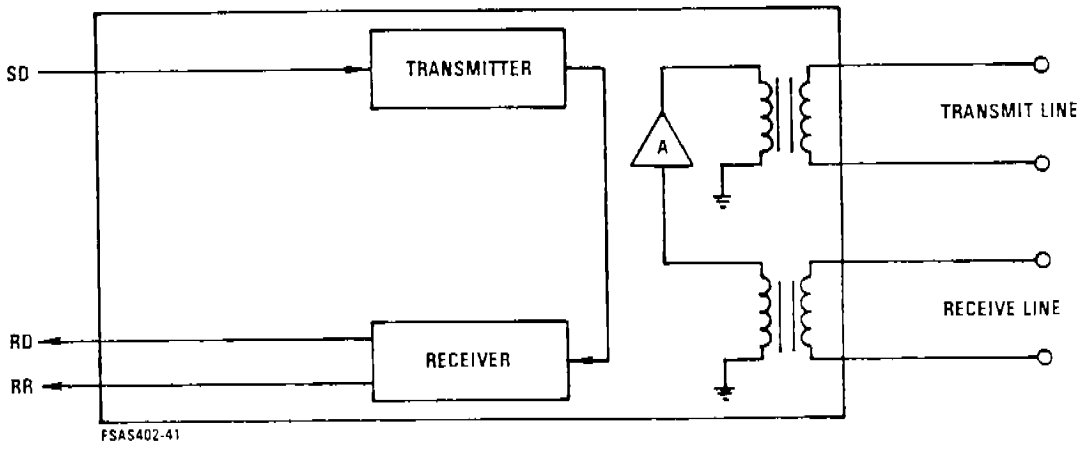

Figure 4-1. RM-208A Analog Loopback Test

4.3.1.2 Digital Loopback. Set the ST/STRO switch to NORM and the AL/DL switch to DL. The circuit configuration for the Digital Loopback (DL) Test is shown in figure 4-2. The analog received data is connected to the receiver input. The receiver output is looped to the transmitter input, and connected to the analog transmit line. The DM line is strapped OFF on the RM-208A card during the DL test. The digital interface lines are looped as follows:

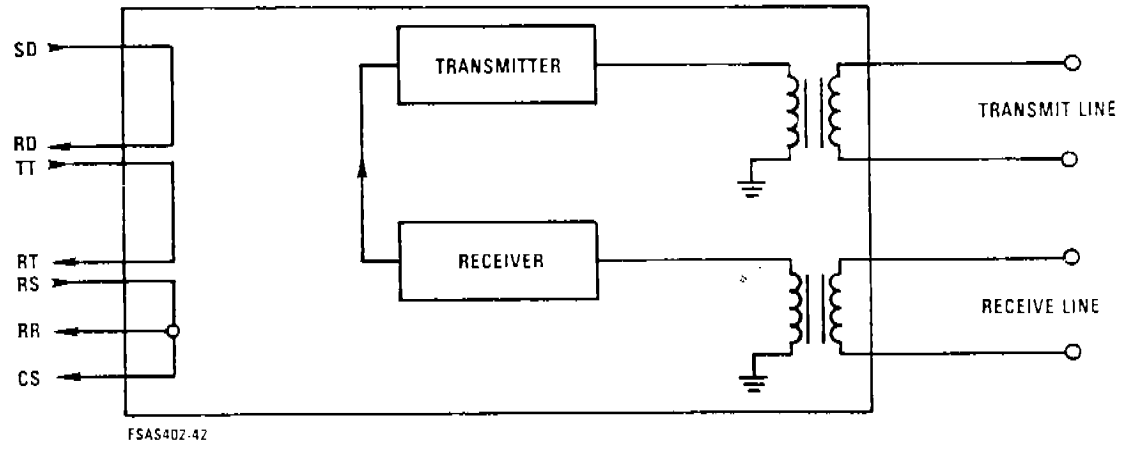

Figure 4-2. RM-208A Digital Loopback Test

a. SD (Send Data) to RD (Receive Data)

b. TT (Terminal Timing not used) to RT (Receive Timing)

c. RS (Request To Send) to RR (Receiver Ready) and CS (Clear To Send)

The status of the LED indicators is as follows:

a. Test - ON

b. TR - ON, if TR line is ON

c. RS - ON, if RS line is ON

d. RR - ON, if RS line is ON

e. CS - OFF

4.3.1.3 Normal Self Test. Set the ST/STRO switch to ST and the AL/DL switch to NORM. The circuit configuration for the Normal Self Test is given in figure 4-3. A test pattern drives the transmitter input, and the transmitter output data is connected to the transmit line. The receiver output is connected to the test pattern detector, and the data is checked for errors. If errors are detected, the TEST LED will flash ON and OFF, or turn OFF.

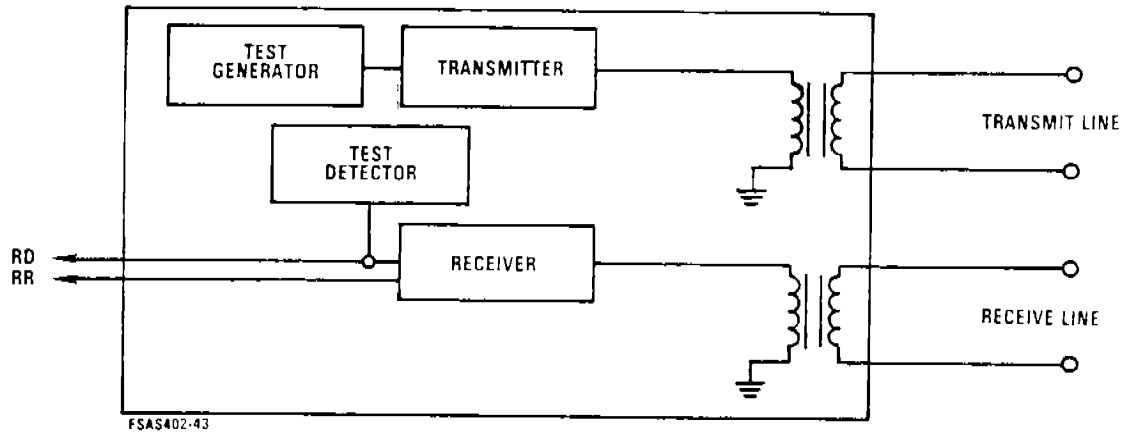

Figure 4-3. RM-208A Normal Self Test

NOTE

The error detector is not active unless a carrier (RR ON) is received from the line.

The RM-208A test pattern is scrambled mark data. The transmitter pattern is generated by the modulo-2 addition of the transmit tri-bit with the quasi-random sequence represented by the polynomial $(1+x^4+x^7)^4$. The receiver subtracts this polynomial from the received tri-bit to recover the transmitted data. Any space data recovered at the receiver (when the modem is in a Self Test mode) is interpreted as an error. The scrambler and descrambler used in the test modes are the same ones used during normal operation.

The RR, SQ (Signal Quality), RT, and ST (Send Timing) outputs are active. The DM (Data Mode) output is inactive. The status of the LED indicators is as follows:

a. Test - ON (unless errors are received and a carrier is present)

b. RR - ON, if the carrier is present

c. RS - ON, if the RS line is ON

d. CS - OFF

e. TR - ON, if the TR line is ON

4.3.1.4 Analog Self Test. Set the ST/STRO switch to ST, and AL/DL switch to AL. The circuit configuration for the Analog Self Test is given in figure 4-4. This test is the same as the Analog Loopback Test (see paragraph 4.3.1.1) except that the transmitter input is the test pattern generator, and the receiver output is connected to the test pattern detector. If data errors occur, the TEST LED will flash ON and OFF, or turn OFF.

The status of the digital interface lines is listed below:

a. SQ - ON (may turn OFF for errors)

b. RR - ON

c. ST - Active

d. RT - Active

e DM - OFF

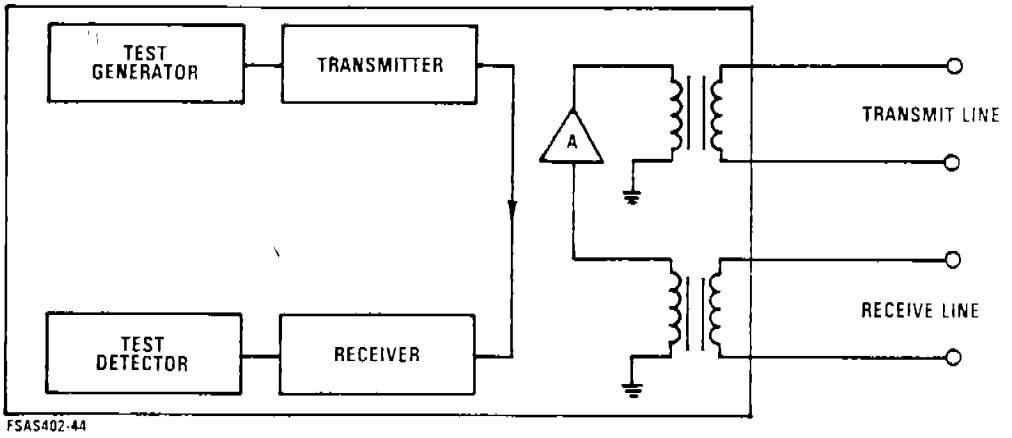

Figure 4-4. RM-208A Analog Self Test

The LED status is:

a. Test - ON unless errors occur

b. TR - Controlled by TR line

c. RS - Controlled by RS line

d. CS - OFF

e. RR - ON

4.3.1.5 Self Test Receive Only. Set the ST/STRO switch to STRO, and the AL/DL switch to NORM. The circuit configuration for the Self Test Receive Only mode is shown in figure 4-5. The transmitter operation is inhibited and the receiver output is connected to the test pattern detector. If data errors are detected, the TEST LED will flash ON and OFF, or turn OFF. This test is not usually performed on 4-wire modems. Normally, the Normal Self Test mode is used with the transmit line output looped to the receive line input.

The status of the digital interface lines is listed below:

a. SQ - ON, when carrier is present

b. RR - ON, when carrier is present

c. DM - OFF

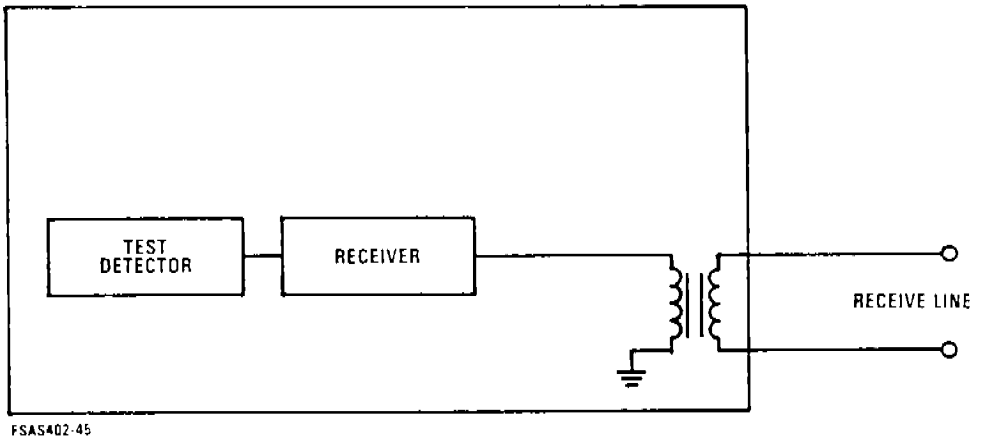

Figure 4-5. RM-208A Self Test Receive Only

The LED status is:

a. Test - ON, unless errors are present

b. RR - ON, if a carrier is present

4.3.2 RM-9600 Self Tests.

4.3.2.1 Analog Loopback. Set the NORM/TEST switch to NORM, and the AL/DL switch to AL. The RM-9600 circuit configuration for the Analog Loopback Test is shown in figure 4-6. The transmitter output is looped into the receiver input. The analog received data is connected to the analog transmit output through an internal buffer amplifier. All of the digital interface signals are active. The DM line is strapped ON during the Analog Loopback Test. The status of the LED indicators is the same as normal operation (refer to paragraph 2.4.1).

4.3.2.2 Digital Loopback. Set the NORM/TEST switch to NORM, and the AL/DL switch to DL. The circuit configuration for the Digital Loopback Test is shown in figure 4-7. The receiver output is connected to the transmitter input and looped to the transmit output. The DM line is inactive. The digital interface lines are looped as listed below:

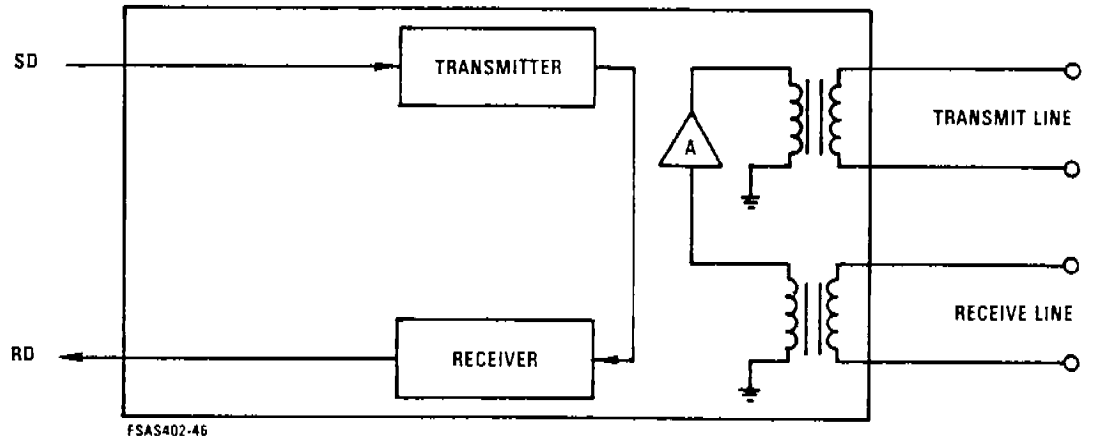

Figure 4-6. RM-9600 Analog Loopback Test

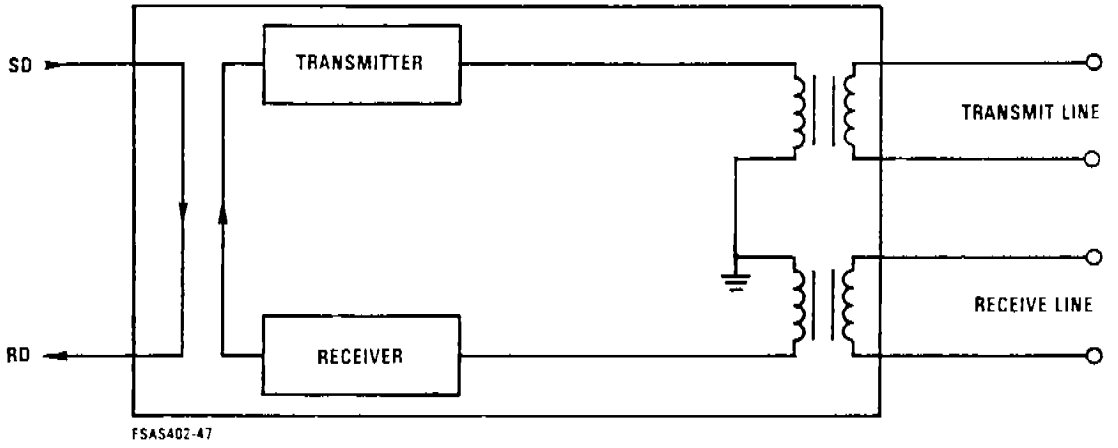

Figure 4-7. RM-9600 Digital Loopback Test

a. SD to RD

b. RT to ST

c. RS to SQ, RR, and CS

The LED status is:

a. Test - ON

b. RR - ON if RS line is ON

c. RS - ON, if RS line is ON

d. CS - ON, if RS line is ON

4.3.2.3 Normal Self Test. Set the NORM/TEST switch to TEST, and the AL/DL switch to NORM. The circuit configuration for the Normal Self Test is given in figure 4-8. The test generator supplies a test pattern for the transmitter input, and the transmitter output drives the card transmit output. The receiver output is connected to the test pattern detector, and the data is checked for errors. If errors are detected, the TEST LED will flash ON and OFF, or turn OFF. The test pattern is a pseudo-random 31-bit polynomial, $1+x^{-2}+x^{-5}$. The status of the digital interface lines is listed below:

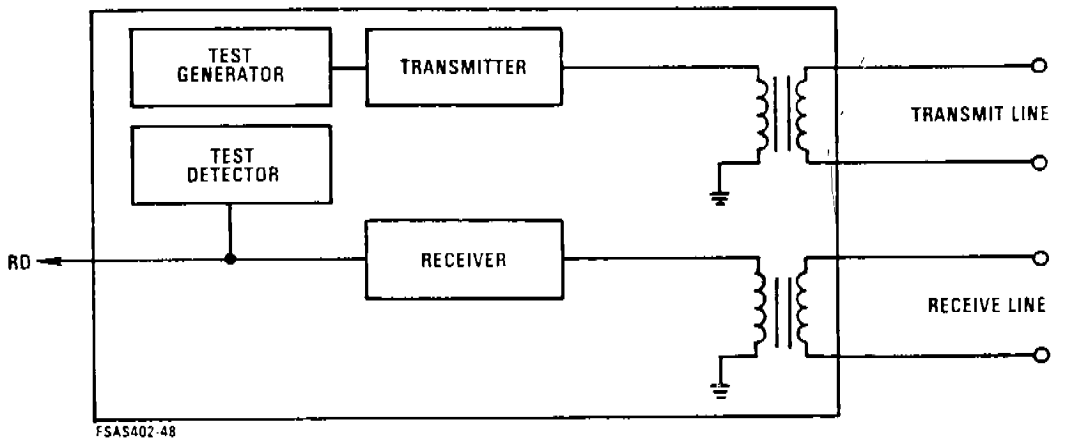

Figure 4-8. RM-9600 Normal Self Test

a. RR - ON

b. SQ - ON

c. CS - OFF

d. DM - OFF

The status of the LED indicators is:

a. Test - ON, unless errors occur

b. RR - ON

4.3.2.4 Analog Self Test. Set the NORM/TEST switch to TEST, and the AL/DL switch to AL. The Analog Self Test is the same as the Analog Loopback Test except that the test pattern generator drives the transmitter input, and the receiver output is connected to the test pattern detector. The circuit configuration for the Analog Self Test is shown in figure 4-9. If errors are detected, the TEST LED will flash ON and OFF, or turn OFF. The status of the digital interface lines is:

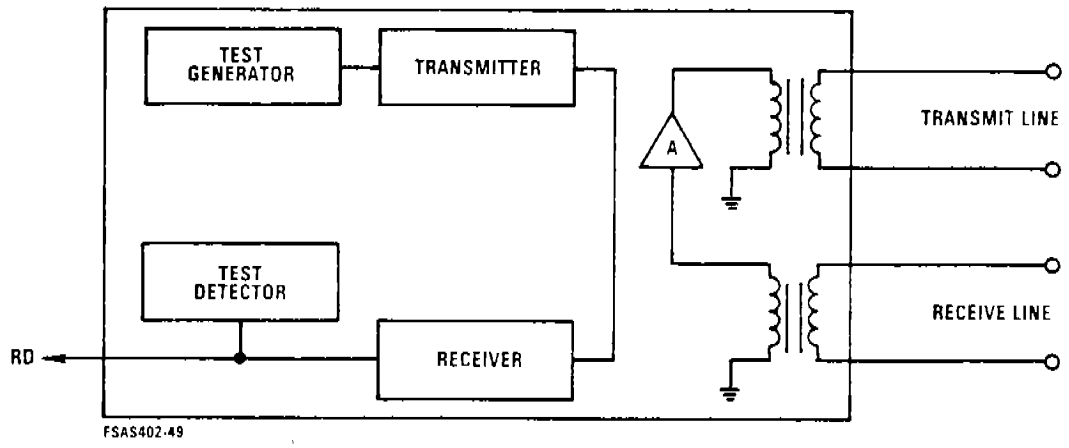

Figure 4-9. RM-9600 Analog Self Test

a. RR - ON

b. DM - OFF

c. CS - OFF

d. SQ - ON

The LED status is:

a. Test - ON, unless errors occur

b. RR - ON

4.3.3 Modem Fault Isolation. Connect the modems as shown in figure 4-10. First, determine that the transmitter and receiver sections of each modem are operating correctly. Place modem A in the Analog Self Test mode (see applicable paragraph 4.3.1.4 or 4.3.2.4). The TEST LED indicator should be ON. If the TEST LED flashes ON and OFF, or remains OFF, the modem is faulty. If modem A performs correctly, run the Analog Self Test on modem B. If both modems operate correctly, the fault is likely to be within the telephone line interface.

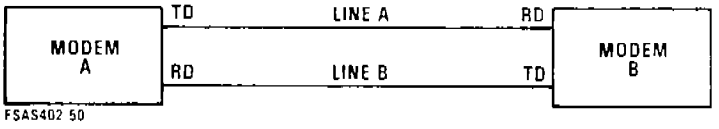

Figure 4-10. Modem Fault Isolation

Place both modems in the Normal Self Test mode (see applicable paragraph 4.3.1.3 or 4.3.2.3). If the TEST LED on modem B is flashing ON and OFF, or remains OFF, the signal level on line A is too low. If the modem A TEST LED is OFF or flashing, the line B signal level is too low. The signal from modem B may be looped through modem A by placing modem A in Analog Loopback, and modem B in Normal Self Test. Analog and Digital Loopback Tests may be performed to check the DTE interface.

NOTE

When testing the RM-9600, the reset switch may need to be depressed to release a lock up condition.

SECTION V

EQUIPMENT INTERFACE

AND

INSTALLATION

5.1 MECHANICAL ASSEMBLY. The RM-8E unit is rack mounted, 19" W X 7" H X 17.8" D. With a full complement of PC cards, the unit weight is approximately 32 pounds. The assembly is completely wired for eight modem channels, a common manual call unit located in slot 0, and two power supplies. The enclosure contains a small 25 CFM fan that circulates cooling air from intake louvers in the enclosure base, and exhausts warm air through the rear of the enclosure.

5.2 INTERFACE CONNECTIONS. The interface connectors for the modem and MCU cards are located on the rear panel as shown in figure 5-1. The rear panel also contains two circuit breakers for each 115 Vac input, connections for chassis ground, and the air exhaust port for the internal fan. Except for slot 0, a 6-pin telephone cable connector and a 37-pin female DTE connector are wired to each card slot.

5.2.1 Digital RS-449 Interface. The eight RS-449 digital input connectors are labeled and shown in figure 5-1. The active pin connections are listed in table 5-1. The DTE interface is supplied by the E-Systems multiplexer (MUX) board and multiplexer interface board (MIB).

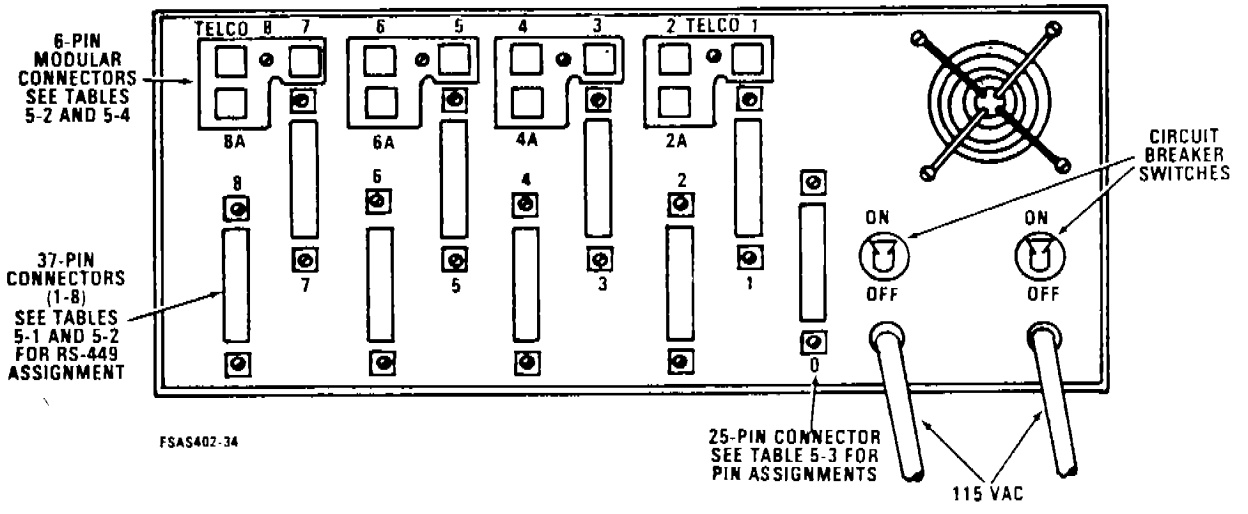

Figure 5-1. RM-8E Interface Connectors

TABLE 5-1

Digital RS-449 Interface, Active Pin Connections

Pin	RS-449 Circuit	Function	Description
1	Shield	Shield	Connected to cable shield at MUX interface board.
2	SI	Signal Rate Indicator	Not used.
3	Spare	Spare	Spare
4	SD A	Send Data A	Data generated by the MUX and supplied to modem.
5	ST A	Send Timing A	Transmit clock supplied to the MUX.
6	RD A	Receive Data A	Data demodulated from the receive data line and supplied to MUX.
7	RS A	Request To Send A	Supplied to the RM-8E modem by the MUX when it is required to transmit data.
8	RT A	Receive Timing A	Receive clock supplied to the MUX by the modem. Clock is in sync with the received data (pin 6 and 24).
9	CS A	Clear To Send A	Function supplied to the MUX indicating it is permissible to begin data transmission.
10	LL	Local Loopback	Function supplied to the RM-8E modem to activate local loopback test mode.
11	DM A	Data Mode A	Function supplied to the MUX indicating that the RM-8E modem is in data mode and ready to accept signals on the digital interface.
12	TR A	Terminal Ready A	Signal from MUX used to control switching of the RM-8E modem to the communication channel.

TABLE 5-1 (continued)

Digital RS-449 Interface, Active Pin Connections

Pin	RS-449 Circuit	Function	Description
13	RR A	Receiver Ready A	Signal indicates the presence of a received carrier by the RM-8E modem.
14	RL	Remote Loopback	Signal from MUX used to activate RM-8E modem to remote loopback test mode.
15	IC	Incoming Call	Signal from the RM-8E modem indicating the presence of a ringing current.
16	SF/SR	Select Frequency/ Signal Rate	MUX Interface Board (MIB) signal source, constant ON condition.
17	TT A	Terminal Timing A	Not used.
18	TM	Test Mode	Signal from RM-8E modem indicating a test condition.
19	SG	Signal GND	Signal GND is tied to signal common in the MIB
20	RC	Receive Common	Tied to signal common in the MUX. Common return for circuits IC, TM, SQ, NS, SI and SB.
21	Spare	Spare	Spare
22	SD B	Send Data B	Send data common.
23	ST B	Send Timing B	Send timing common.
24	RD B	Receive Data B	Receive data common.
25	RS B	Request to Send B	Request to send common.
26	RT B	Receive Timing B	Receive timing common.

TABLE 5-1 (continued)

Digital RS-449 Interface, Active Pin Connections

Pin	RS-449 Circuit	Function	Description
27	CS B	Clear To Send B	Clear To Send common.
28	IS	Terminal in Service	Signal indicates the MUX is available for service, MIB signal source, constant ON condition.
29	DM B	Data Mode B	Data mode common.
30	TR B	Terminal Ready B	Terminal ready common.
31	RR B	Receiver Ready B	Receiver ready common.
32	SS	Select Stand By	Not used. (MIB constant OFF)
33	SQ	Signal Quality	Signal indicates a reasonable probability of an error in the receive data.
34	NS	New Signal	Not used. (MIB constant off)
35	TT B	Terminal Timing B	Not used.
36	SB	Stand By Indicator	Not used.
37	SC	Send Common	Tied to signal common in the MUX. Common return for LL, RL, SF/SR and IS.

5.2.2 Telephone Line Interface. The rear panel contains twelve 6-pin modular connectors used for the telephone interface to the modem cards. The private line modems have four connections for the Transmit Pair (T) and Receive Pair (R). Figure 5-2 shows the telephone interface connections for the RM-8E enclosure. The pin-to-pin connections between the enclosure card edge and the 6-pi modular connectors are given in tables 5-2 and 5-4.

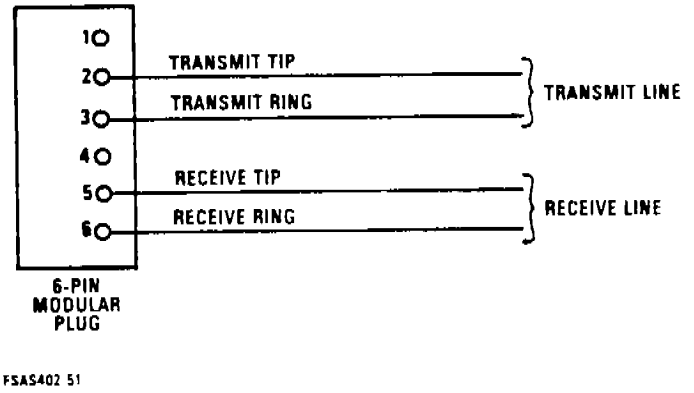

Figure 5-2. Telephone Line Connection, Private Line

5.2.3 RM-8E Enclosure Configurations. The RM-8E enclosure is wired to allow a common manual call unit to be used in slot 0 for the RM-208 modem card(s), when paired with the RM-A/O card(s). The RM-8E enclosure configurations are shown in figure 5-3, and follow these four guidelines:

1. Slot 0 accepts the RM-800 MCU card only.
2. Slots 1 through 8 accept RM-208A or RM-9600 modems for private line use.
3. Slots 1, 3, 5, and 7 accept the RM-208A modem for operation on the DDD network.
4. Slots 2, 4, 6, and 8 accept the RM-A/O card for use with its designated RM-208A modem.

When private line modems (RM-208A or RM-9600) are used in any slot, 1 through 8, the telephone line interface connector is the corresponding TELCO connector number 1 through 8, as shown in

PC Card Type	Slot Number								
	0	1	2	3	4	5	6	7	8
RM-800 MCU	X								
RM-9600 (Private Line Operation)		X	X	X	X	X	X	X	X
RM-208A (Private Line Operation)		X	X	X	X	X	X	X	X
RM-208A (Switched DDD Network Operation)		X		X		X		X	
RM-A/O			X		X		X		X

Figure 5-3. Modem Enclosure Configurations

figure 5-1. If the RM-208A and RM-A/O Direct Distance Dialing (DDD) network modems are used, the TELCO connectors used are 2, 2A, 4, 4A, 6, 6A, and 8, 8A. Connectors 2 (Transmit Pair) and 2A (Receive Pair) are used for slots 1 and 2, etc. The 37-pin connectors 2, 4, 6, and 8 are not used for DDD network modems.

5.2.4 RM-8E Enclosure Power Supplies. The enclosure contains two power supply modules, each capable of supplying the entire 9-card enclosure. Only one power supply module is connected to the enclosure cards at any time; the other module is in standby. Each module has voltage comparison circuits. These modules and the load are cross coupled so that either module can assume the load in case of a single voltage or module failure. The on-line power supply provides $\pm$ 12 Vdc and +5 Vdc to the other enclosure cards. The card edge connector pins for the power inputs are listed in tables 5-2 through 5-4.

5.2.5 RM-8E Edge Card Connections. Each modem card is plugged into the RM-8E enclosure. Connection to a printed circuit motherboard is made through individual pin connectors which interconnect the modem to the 37-pin DTE connector and the 6-pin telephone connector, both located on the rear panel. The motherboard also brings power supply voltage inputs to each card. The modem card pin assignments and functions for slots 1 through 8 are shown in table 5-2. Pin functions for the RM-800 MCU and the RM-A/O cards are shown in tables 5-3 and 5-4 respectively.

Table 5-2

Modem Edge Card Connections, Slot 1 Through 8

Connector Pin No.'s	Function	RS-449 Conn. Pin No.
N/C	Shield (No Connection)	1
64	SI	2
N/C	Spare	3
13	SD A	4
49	ST A	5
12	RD A	6
11	RS A	7
47	RT A	8
9	CS A	9
46	LL	10
5	DM A	11
44	TR A	12
8	RR A	13
60	RL	14
7	IC	15
68	SF/SR	16
41	TT A	17
4	TM	18
35, 36, 71, 72	SYS GND	19
--	RC	20
N/C	Spare	21

Table 5-2 (continued)

Modem Edge Card Connections, Slots 1 Through 8

Connector Pin No.'s	Function	RS-449 Conn. Pin No.
14	SD C	22
--	ST C	23
--	RD C	24
10	RS C	25
--	RT C	26
--	CS C	27
40	IS	28
--	DM C	29
45	TR C	30
--	RR C	31
N/C	SS	32
43	SQ	33
61	TT C	34
42	TT C	35
39	SB	36
28	SC	37

Table 5-2 (continued)

Modem Edge Card Connections, Slots 1 Through 8

Connector Pin No.'s	Function	6-Pin Modular Jack
1, 2, 37, 38	+5VDC	
15, 51	+12VDC	
16, 52	-12VDC	
17, 53	* TIP (BUS)	
18, 54	* RING (BUS)	
19, 55	+12VDC Relay	
21	* Line Sel 1	
26	* Line Sel 2	
57	* Data Mode	
58	* Talk Mode	
59	* Busy	
29	TIP	2, 4
30	RING	3
31	REC TIP	5
32	REC RING	6

* Interface signals between RM-800 MCU and RM-A/O Board.

Table 5-3

RM-800 MCU (Manual Call Unit)

Card Edge Connection, Slot 0 Only

Connector Pin No.'s	Function	25-Pin Conn. Pin Numbers
--	Chassis GND	1 (Shield)
10	TIP (Telephone)	5
35, 36, 71, 72	SYS GND	7
6	RING (Telephone)	11
50	EK (Exclusion Key)	14
48	EK1 (EX Key Comm)	16
45	A1 (Switch hook)	19
42	A (Switch hook)	23
		25 (Spare)
12, 37, 38	+5VDC	
15, 51	+12VDC	
16, 52	-12VDC	
17, 53	TIP (Bus)	
18, 54	RING (Bus)	

Table 5-3 (continued)

RM-800 MCU (Manual Call Unit)

Card Edge Connection, Slot 0 Only

Connector Pin No.'s		Function	25-Pin Conn. Pin Numbers
19, 55		+12VDC Relay	
20	*	S7	
21	*	S5	
22	*	S6	
24	*	S4	
25	*	S3	
26	*	S1	
62	*	S2	
57		Data Mode	
58		Talk Mode	
59		Busy	

* Modem Select Lines, active low.

Table 5-4

RM-A/O Special Card Edge Connection.

Slot(s) 2, 4, 6 or 8

Connector Pin No.'s	Function	6-Pin Modular Conn. (Modem)	6-Pin Modular Conn. (Special)
29	TIP (Line 1)	2, 4	
30	RING (Line 1)	3	
31	REC TIP (Not Used)	5	
32	REC RING (Not Used)	6	
69	TIP (Line 2)		2, 4
70	RING (Line 2)		3
1, 2, 37, 38	+5VDC		
15, 51	+12VDC		
16, 52	-12VDC		
17, 53	+12VDC Relay		
18, 54	TIP (BUS)		
19, 55	RING (BUS)		
57	Data Mode		
58	Talk Mode		
59	Busy		
21	Line Sel 1		
26	Line Sel 2		
24	Line Sel 3	Tie to Pin 21 of Associated Modem	
25	Line Sel 4	Tie to Pin 26 of Associated Modem	
65	Xmit TIP	Tie to Pin 29 of Associated Modem	
66	Xmit Ring	Tie to Pin 30 of Associated Modem	
67	REC TIP	Tie to Pin 31 of Associated Modem	

Table 5-4 (continued)

RM-A/O Special Card Edge Connection,

Slot(s) 2, 4, 6 or 8

Connector Pin No.'s	Function	6-Pin Modular Conn. (Modem)	6-Pin Modular Conn. (Special)
68	REC RING	Tie to Pin 32 of Associated Modem	
27	TR'	Tie to Pin 32 of Associated Modem	
56	DM EN	Tie to Pin 56 of Associated Modem	
3	TM'	Tie to Pin 4 of Associated Modem	
48	TR A'	Tie to Pin 44 of Associated Modem	
50	TR C'	Tie to Pin 45 of Assoicated Modem	
6	DM'	Tie to Pin 5 of Associated Modem	
33	IC	Tie to Pin 33 of Associated Modem	

Associated modem is the modem in adjacent odd numbered slot. If Rm-A/O is in slot 2, the associated modem is in slot 1, etc.

SECTION VI

DIAGRAMS

6.1 RM-8E DIAGRAMS. This section contains schematics for all of the RM-8E cards. The jumper configurations are supplied for the RM-208A and RM-9600 modems, and the RM-A/O (Answer/Originate) card.

TABLE 6-1

Index of Diagrams

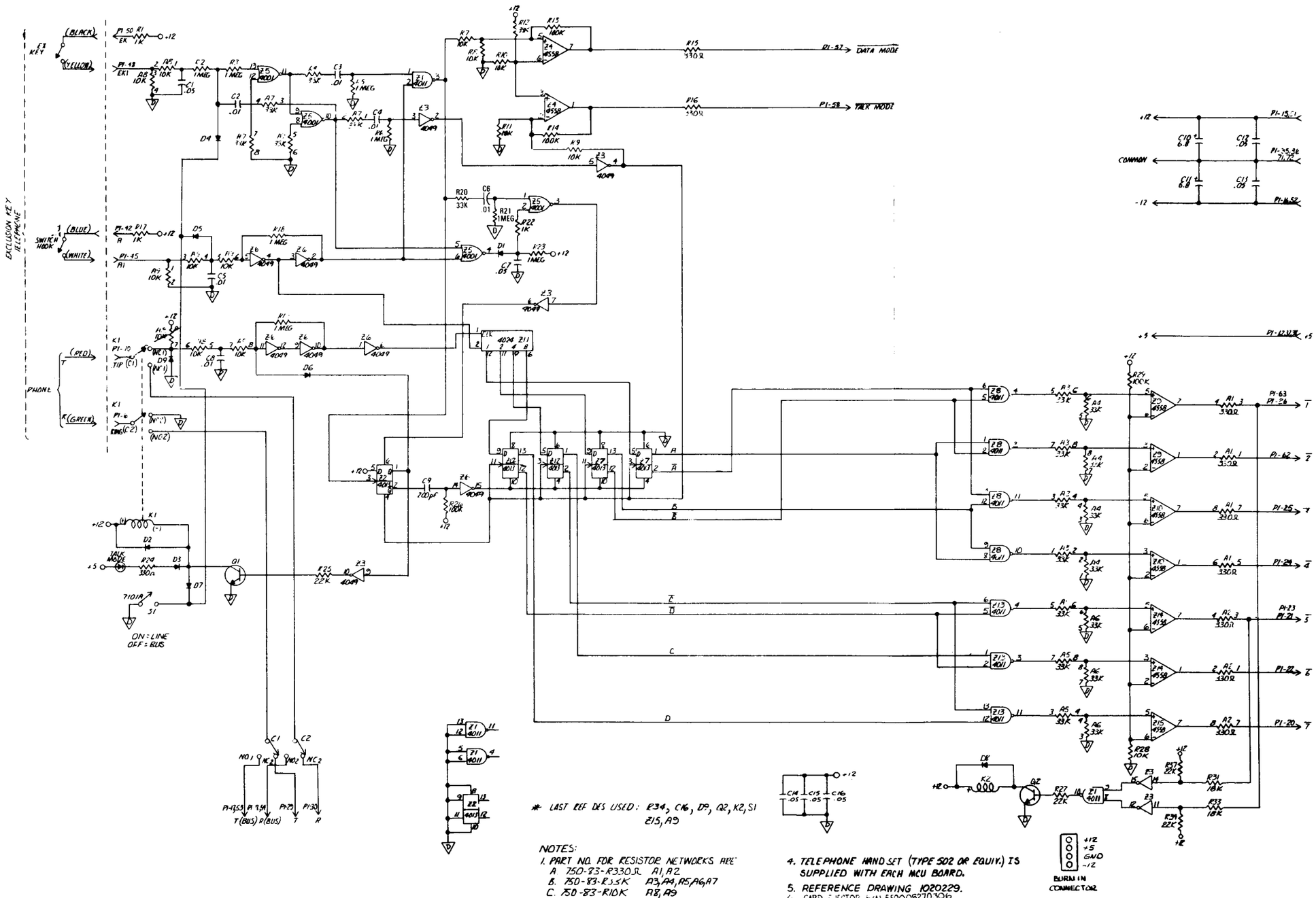

Figure 6-1. RM-800 MCU (Manual Call Unit), 1020377, Schematic Diagram

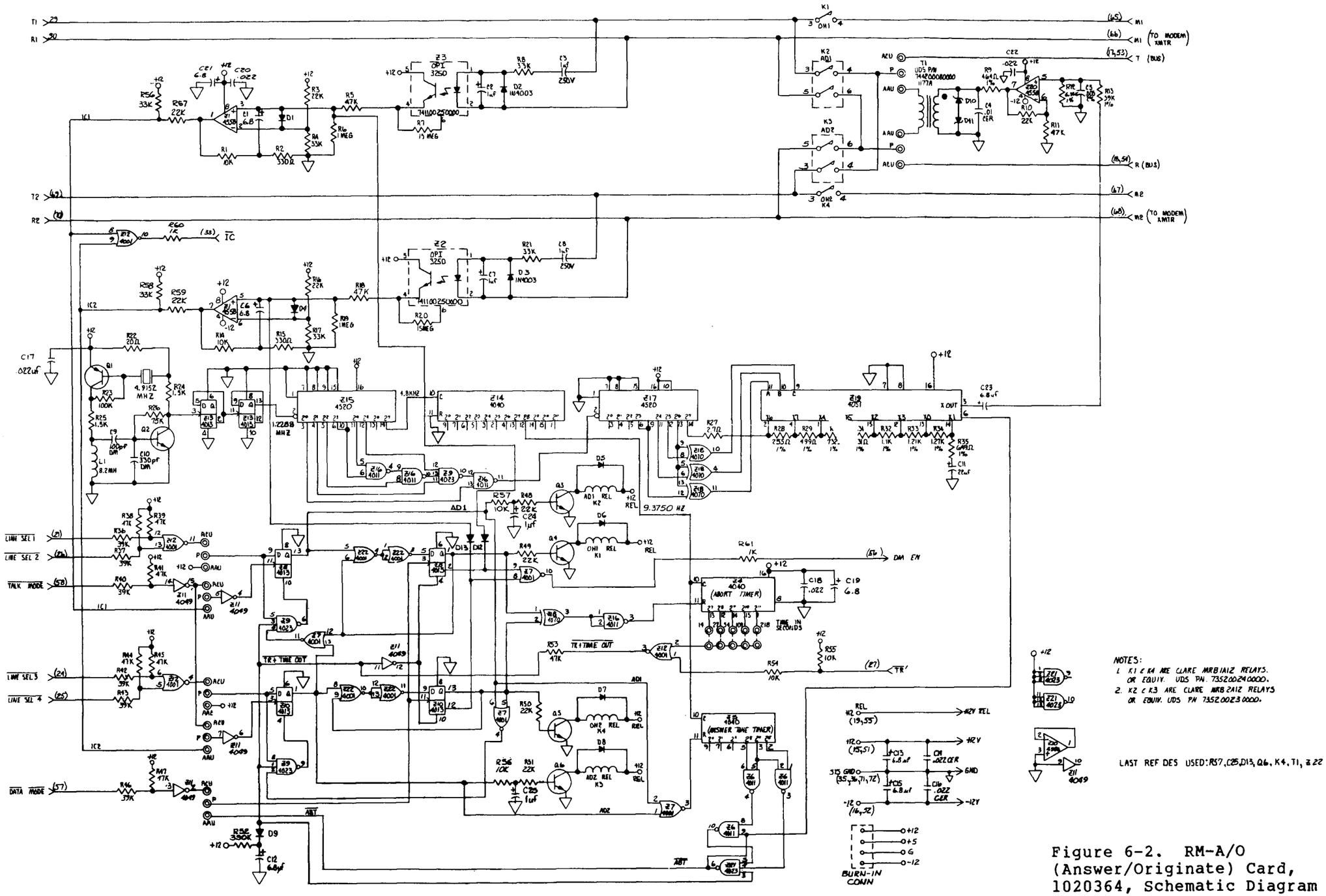

Figure 6-2. RM-A/O (Answer/Originate) Card, 1020364, Schematic Diagram

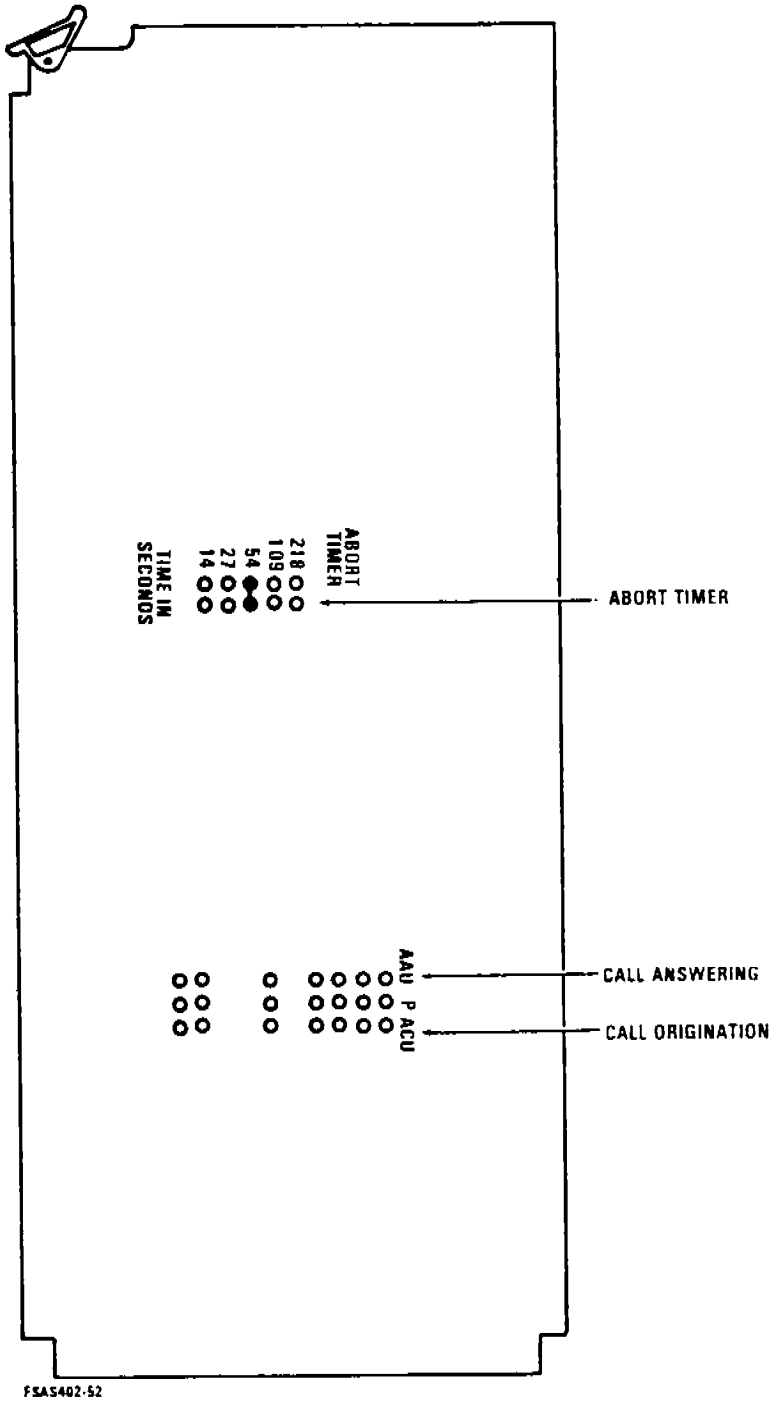

Figure 6-3. RM-A/O (Answer/Originate) Jumper Configuration

Figure 6-4. RM-208A Modem Card, 2082278, Schematic Diagram (Sheet 1 of 2)

Figure 6-4. RM-208A Modem Card, 2082278, Schematic Diagram (Sheet 2 of 2)

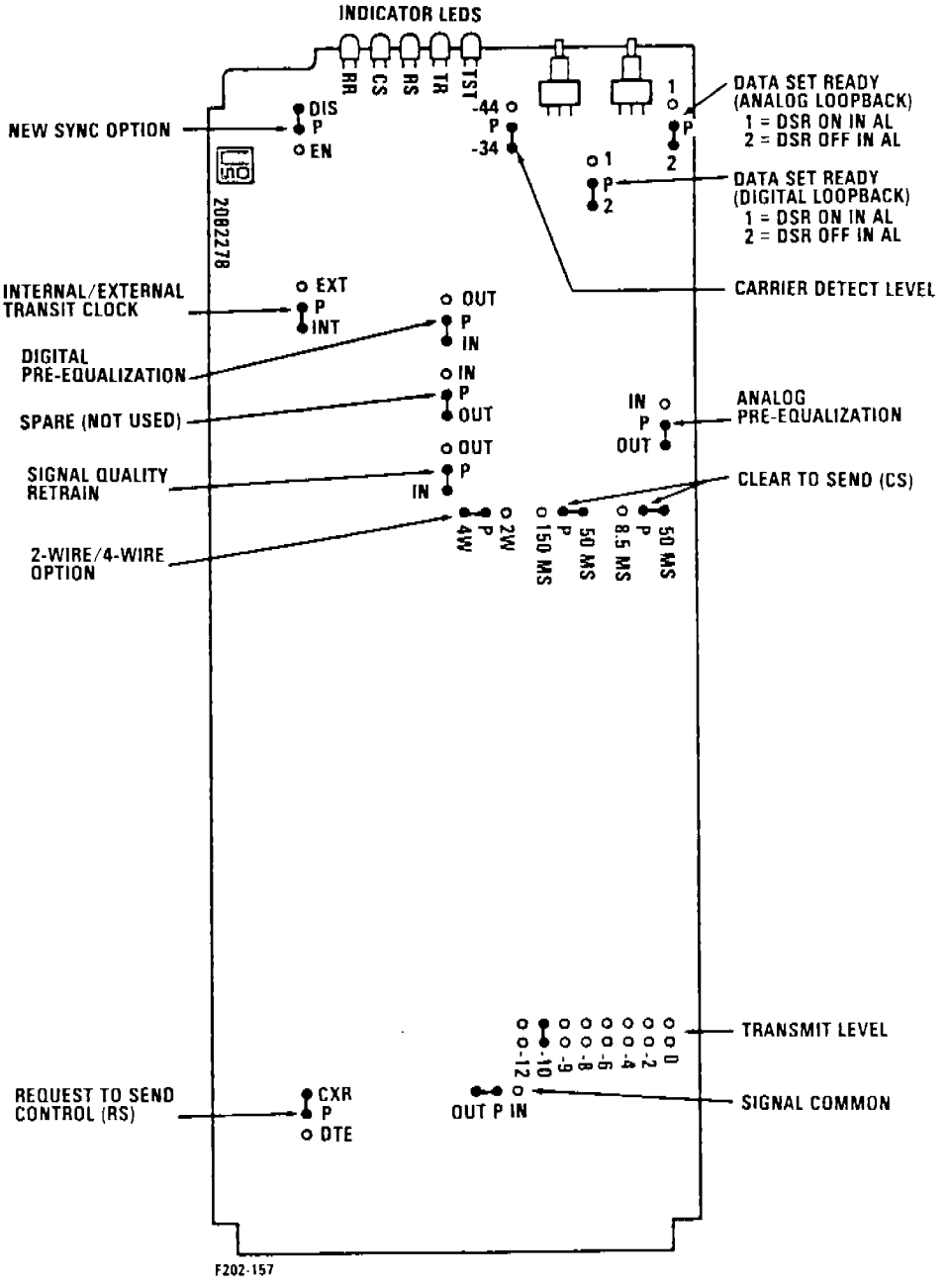

Figure 6-5. RM-208A Jumper Configuration

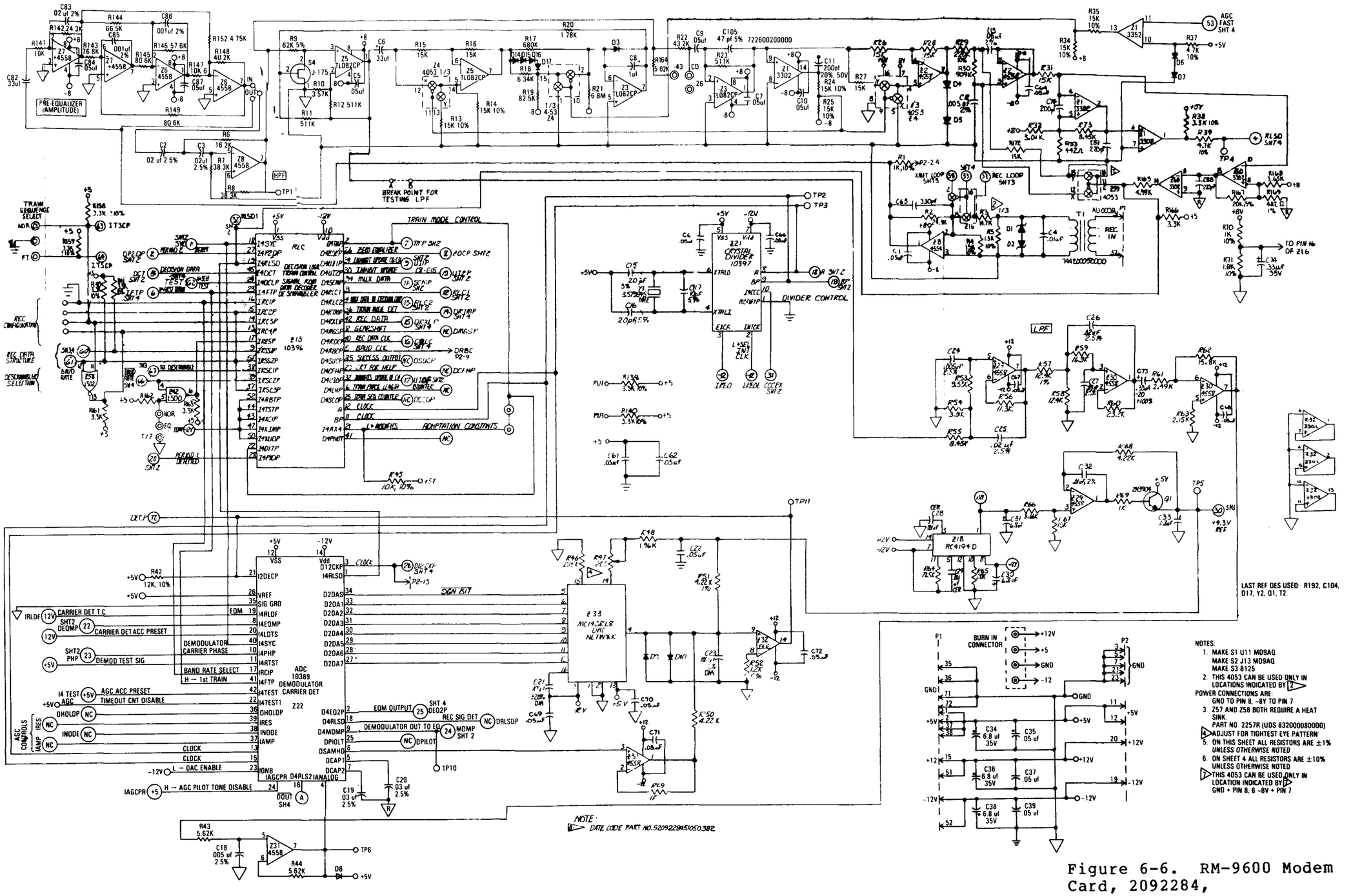

Figure 6-6. RM-9600 Modem Card, 2092284, Schematic Diagram (Sheet 1 of 4)

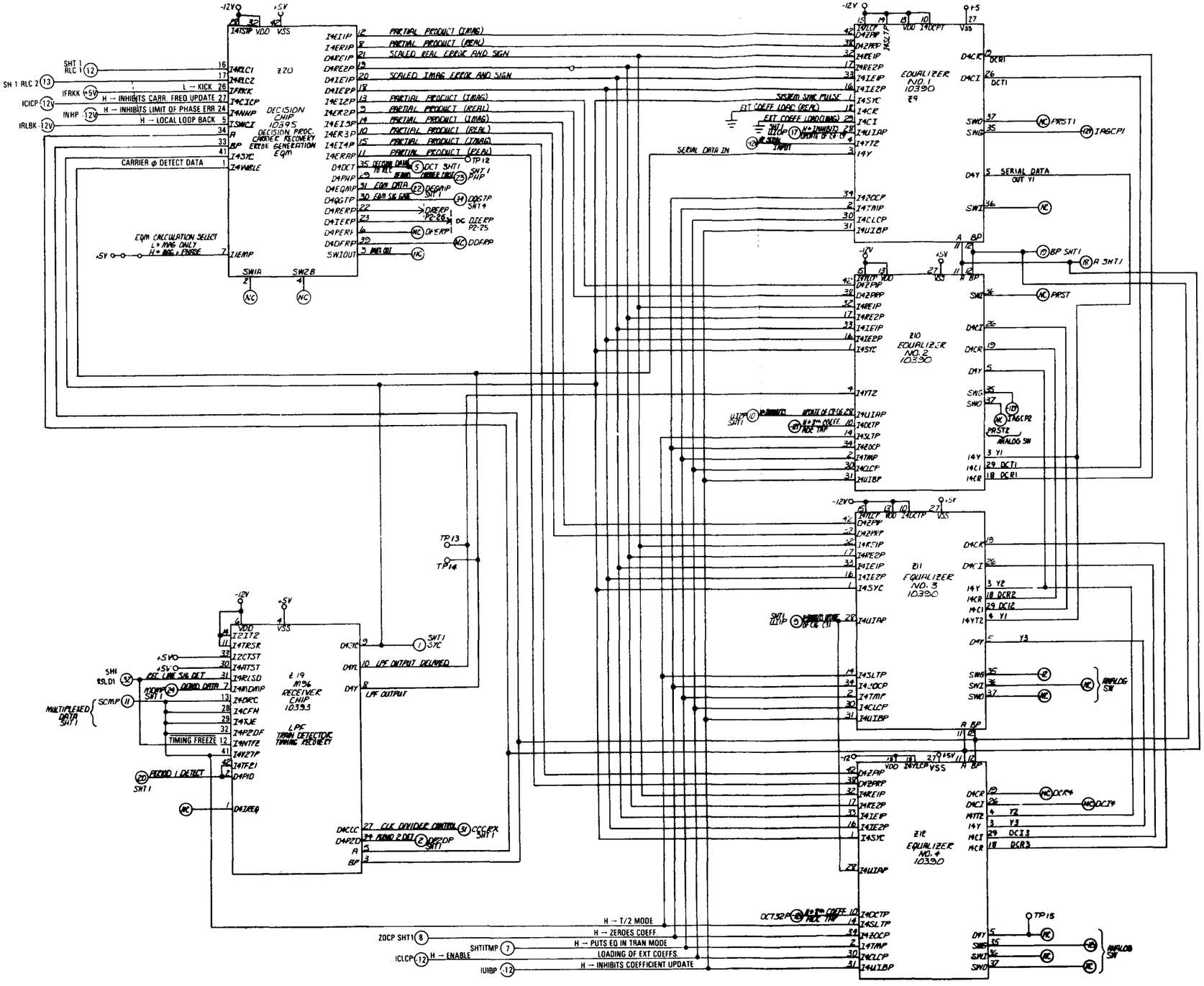

Figure 6-6. RM-9600 Modem Card, 2092284, Schematic Diagram (Sheet 2 of 4)

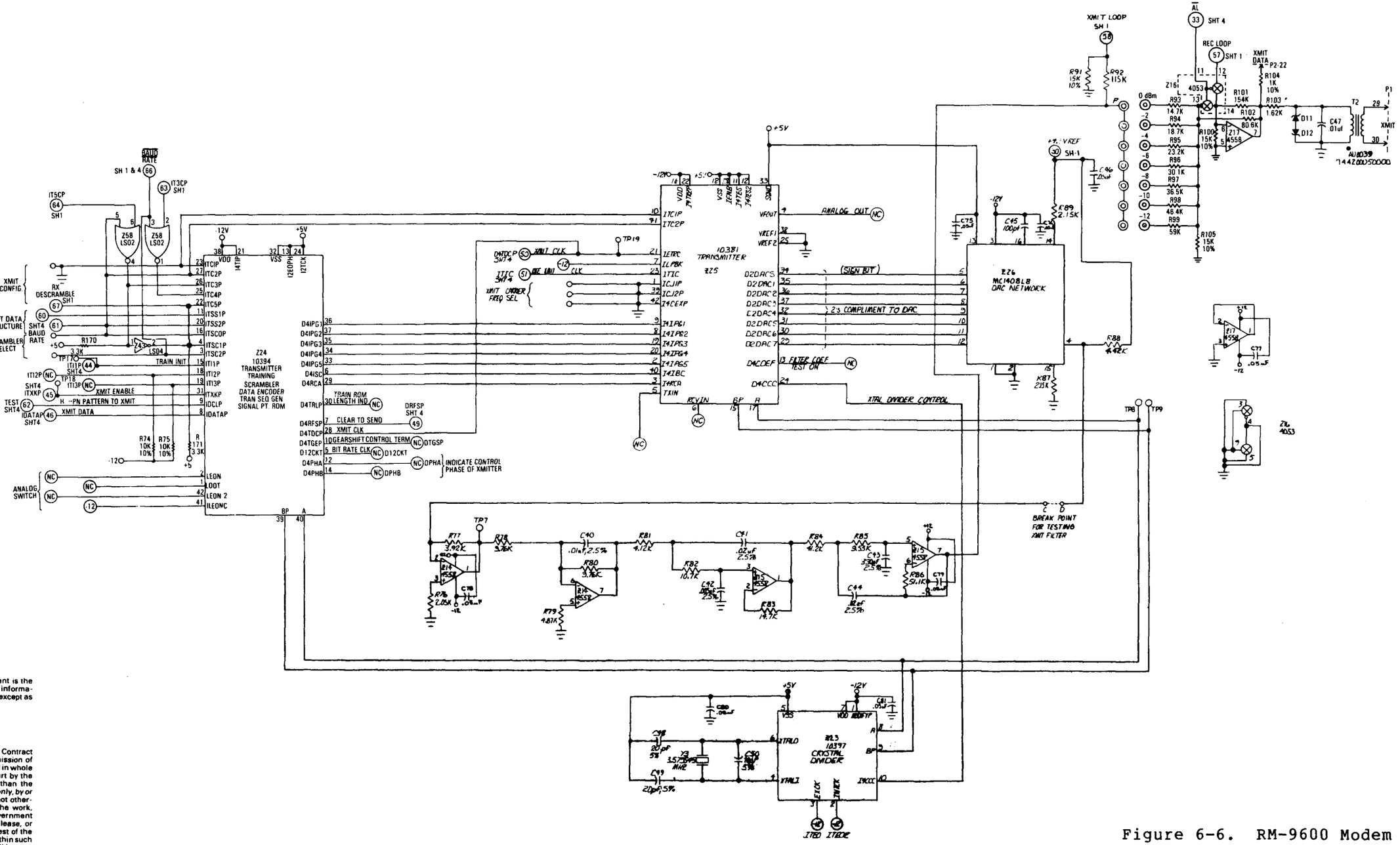

Figure 6-6. RM-9600 Modem Card, 2092284, Schematic Diagram (Sheet 3 of 4)

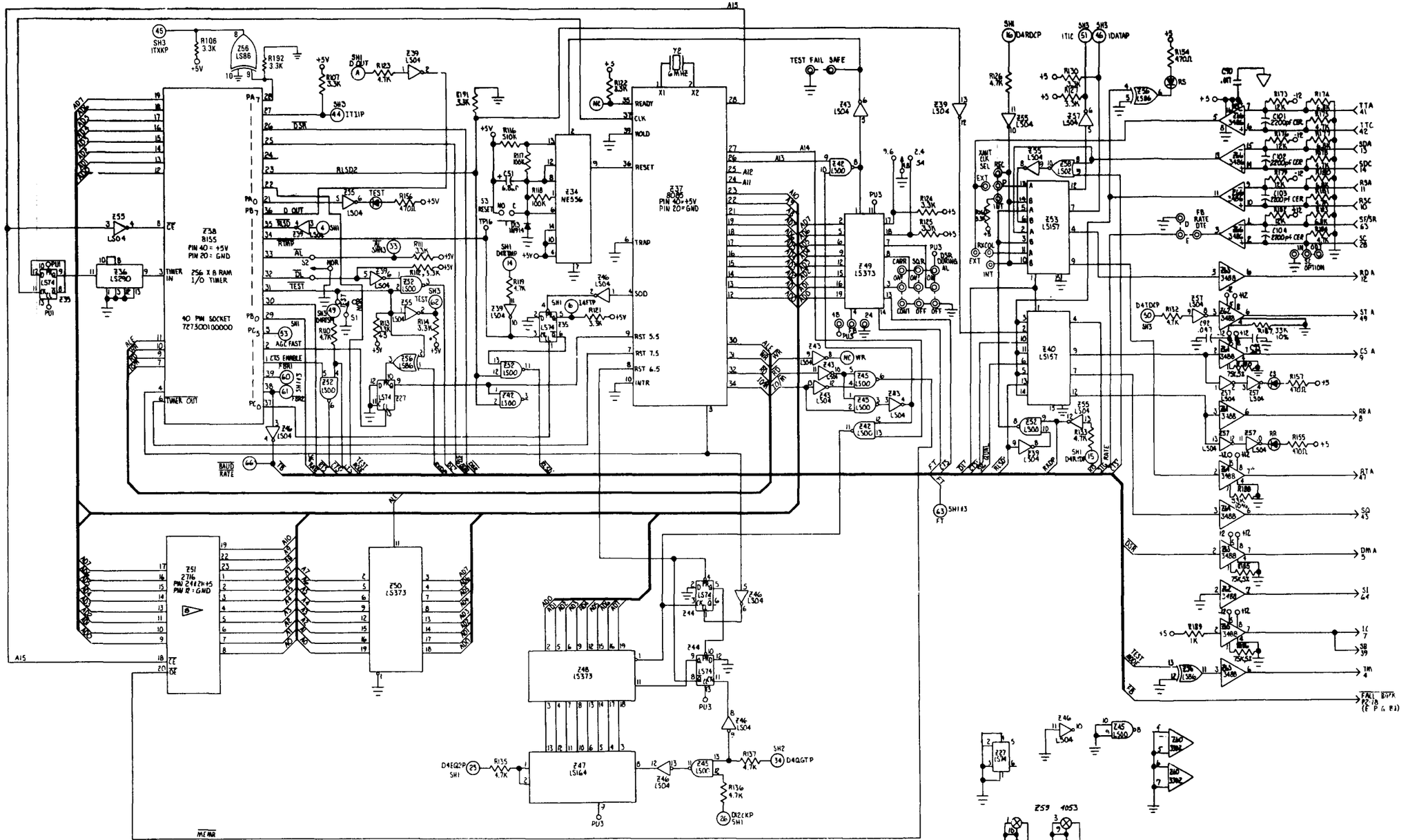

Figure 6-6. RM-9600 Modem Card, 2092284, Schematic Diagram (Sheet 4 of 4)

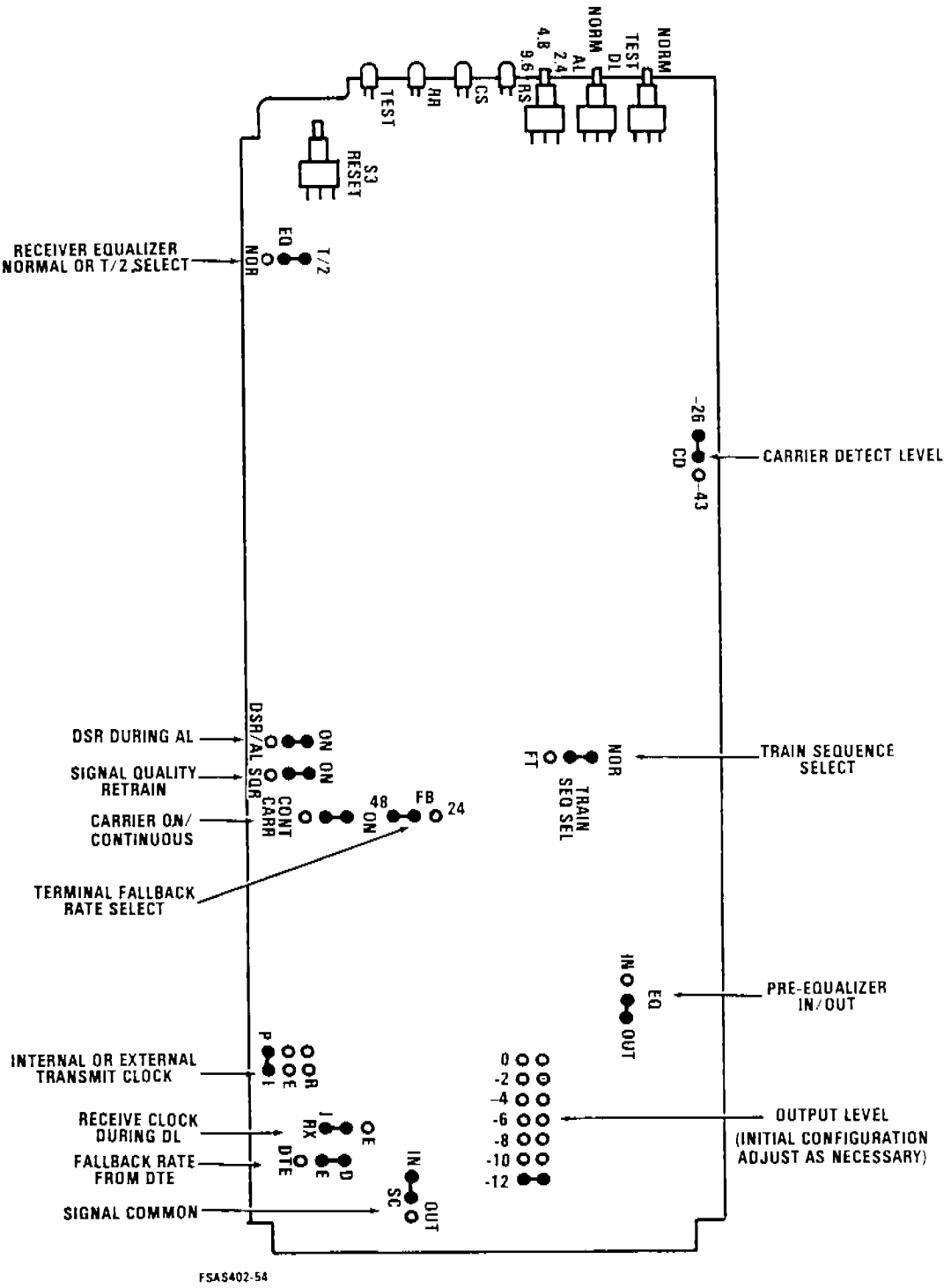

Figure 6-7. RM-9600 Jumper Configuration

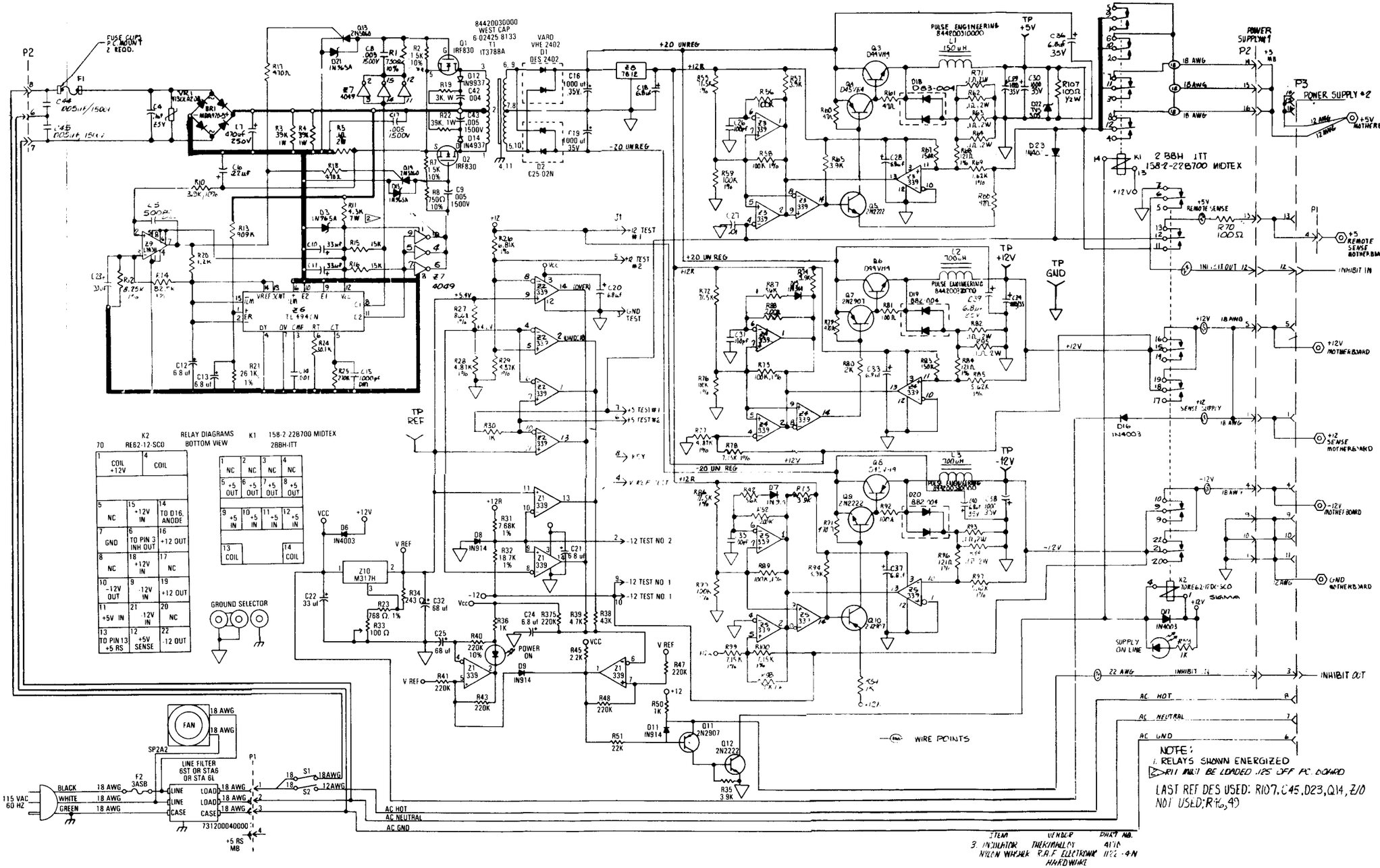

Figure 6-8. RM-8E Switching Power Supply Card, 1020249J, Schematic Diagram

SECTION VII

PARTS LIST

7.1 GENERAL. This section contains the replaceable parts list for the RM-8E multiple modem system. The modem system may be arranged in several configurations as previously shown in figure 5-3.

7.2 PARTS LIST. Part numbers for the RM-8E enclosure and the applicable plug-in, printed circuit cards shown below are listed in Table 7-1.

TABLE 7-1

RM-8E MODEM ENCLOSURE

INDENT	REF DES	NOMENCLATURE	PART NO.
A		RM-8E MODEM ENCLOSURE	2005060
B		FILTER, LINE 120V 6A EMI	3120004
B		LATCH, CONNECTOR	3180084
B		MOTHER BOARD, RM-8E	1020366
B		BRACKET, CONNECTOR MTG	5000621
B		CORD, POWER	3010002
B		CIRCUIT BREAKER	3150002
B		RELAY	3520002
B		FAN	SU2A5
B		COVER, MODULAR JACK	5001058
B		PANEL REAR	5001054
B		PANEL, PARTITION	5000549
B		PANEL, TOP	5001056
B		PANEL, BOTTOM	5001055
B		PANEL, SIDE	5005544
B		PANEL, FRONT	5000940-003
B		RM-8E SWITCHING POWER SUPPLY CCA	1020249
C		CLP FUSE 3AG PCB MOUNT	2680002
C		FUSE, 3 AMP	3150024
C		XFMR PWR SWITCHING PS	4420030
C		VARISTOR	3660004

TABLE 7-1

RM8E SWITCHING POWER SUPPLY

INDENT	REF DES	NOMENCLATURE	PART NO.
C		RECT ASSY BRIDGE 4A/400V	4170008
C		RECT ASSY BRIDGE 10A	4170011
C		RECT ASSY BRIDGE 5A	4170012
C		LED	4190006
C		RELAY 6C 12V/90	3520028
C		RELAY 2C 12V/160	3520050
C		IC VOLT REGULATOR	4180018
C		DIODE SWITCHING 100V	4130003
C		DIODE 1 AMP	4130018
C		RECT ASSY BRIDGE 25A	4170009
C		RECT ASSY BRIDGE 10A	4170010
C		DIODE 15 VOLT	4130019
C		DIODE GENERAL PURPOSE	4130004
C		DIODE TRANSIT	4130020
C		INDUCTOR, 160UH	4420031
C		INDUCTOR, 700UH	4420032
C		IC VOLT REGULATOR	4180006
C		TRANSISTOR	4140001
C		TRANSISTOR	4140003
C		TRANSISTOR	4140020
C		TRANSISTOR	4140021

TABLE 7-1

RM-8E SWITCHING POWER SUPPLY (Continued)

INDENT	REF DES	NOMENCLATURE	PART NO.
C		IC VOLTAGE COMPARATOR	4110006
C		IC CMOS CER HEX INVERTER	4154049
C		IC QUAD V COMP	4110017
C		IC VOLTAGE REGULATOR	4180017
C		PULL CARD	5000827
C		CAPACITOR, 200V	2280030
C		CAPACITOR, 600V	2260026
C		CAPACITOR, 1500V	2260034
C		CAPACITOR, 1KV	2260013
C		CAPACITOR, 50V	2260005
C		CAPACITOR, 35V	2280031
C		CAPACITOR, 16V 33UF	2250012
C		CAPACITOR, 35V .22UF	2250001
C		CAPACITOR, 35V .68UF	2250003
C		CAPACITOR, 16V 6.8UF	2250005
C		CAPACITOR, 100V	2270008
C		CAPACITOR, 500V	2270003
C		RESISTOR 1W	3600393
C		RESISTOR 7W	3630432
C		RESISTOR 1W	3600393
C		RESISTOR 7W	3630432
C		RESISTOR 2W	3610108

TABLE 7-1

RM8E SWITCHING POWER SUPPLY (Continued)

INDENT	REF DES	NOMENCLATURE	PART NO.
C		POTENTOMETER	3640001
C		RESISTOR 47 OHM 1/4W	3560470
C		RESISTOR 1K OHM 1/4W	3560102
C		RESISTOR 200K OHM 1/4W	3550204
C		RESISTOR 100 OHM 1/4W	3560101
C		RESISTOR 220K OHM 1/4W	3560224
C		RESISTOR 56K OHM 1/4W	3560563
C		RESISTOR 150K OHM 1/4W	3560154
C		RESISTOR 100K OHM 1/4W	3560104
C		RESISTOR 15K OHM 1/4W	3560153
C		RESISTOR 3.9K OHM 1/4W	3560392
C		RESISTOR 270K OHM 1/4W	3560274
C		RESISTOR 470 OHM 1/4W	3560471
C		RESISTOR 2.2K OHM 1/4W	3560222
C		RESISTOR 22K OHM 1/4W	3560223
C		RESISTOR 4.7K OHM 1/4W	3560472
C		RESISTOR 1.2K OHM 1/4W	3560122
C		RESISTOR 43K OHM 1/4W	3550433
C		RESISTOR 121 OHM 1/4W	3571210
C		RESISTOR 71.5K OHM 1/8W	3577152
C		RESISTOR 5.62K OHM 1/8W	3575621

TABLE 7-1

RM8E SWITCHING POWER SUPPLY (Continued)

INDENT	REF DES	NOMENCLATURE	PART NO.
C		RESISTOR 16.2K OHM 1/8W	3571622
C		RESISTOR 866 OHM 1/8W	3578660
C		RESISTOR 2.0K OHM 1/8W	3572001
C		RESISTOR 4.87K OHM 1/8W	3574871
C		RESISTOR 768 OHM 1/8W	3577680
C		RESISTOR 100K OHM 1/8W	3571003
C		RESISTOR 30.1K OHM 1/8W	3573012
C		RESISTOR 909K OHM 1/8W	3579093
C		RESISTOR 26.1K OHM 1/8W	3572612
C		RESISTOR 82.5K OHM 1/8W	3578252
C		RESISTOR 243 OHM 1/8W	3572430
C		RESISTOR 6.81K OHM 1/8W	3576811
C		RESISTOR 7.68K OHM 1/8W	3577681
C		RESISTOR 18.7K OHM 1/8W	3571872
C		RESISTOR 7.15K OHM 1/8W	3577151
C		CAPACITOR 50V	2260004
C		CAPACITOR 35V	2250017
C		RESISTOR 1.5K OHM 1/4W	3560152
C		RESISTOR 100 OHM 1/2W	3590101
C		RESISTOR 8.25K OHM 1/8W	3578251
C		RESISTOR 750 OHM 1/4W	3550751

TABLE 7-1

RM-8E MCU (MANUAL CALL UNIT)

INDENT	REF DES	NOMENCLATURE	PART NO.
A		PCB ASSY RMS-MAN CALL UNIT	1020377
B		RELAY 2C 12V/290	3520031
B		LED	4190006
B		DIODE 100V	4130003
B		SWITCH	4360004
B		TRANSISTOR	4140007
B		RESISTOR 4-330 OHM	3650001
B		RESISTOR 4-33K	3650002
B		RESISTOR 4-10K	3650014
B		PULL CARD, WHITE	5000827
B		FRONT PANEL	5001097
B		IC CMOS QUAD 2-INPUT	4154011
B		IC OP-AMP DUAL	4110013
B		IC CMOS DUAL FLIP/FLOP	4154013
B		IC CMOS 7-STG RIPL COUNTER	4154024
B		IC CMOS HEX INVERTER	4154049
B		IC CMOS QUAD 2-INPUT NOR	4154001
B		TELEPHONE HAND SET	3500001
B		CAPACITOR 6.8UF	2250005
B		CAPACITOR CER RDL .01UF	2260009
B		CAPACITOR CER RDL .047UF	2260010
B		CAPACITOR DM 200 PF 500V	2270005
B		RESISTOR 1K OHM 1/4W	3560102

TABLE 7-1

RM-8E MCU (MANUAL CALL UNIT) (Continued)

INDENT	REF DES	NOMENCLATURE	PART NO.
B		RESISTOR 10K OHM 1/4W	3560103
B		RESISTOR 100K OHM 1/4W	3560104
B		RESISTOR 1M OHM 1/4W	3560105
B		RESISTOR 18K OHM 1/4W	3560183
B		RESISTOR 22K OHM 1/4W	3560223
B		RESISTOR 330 OHM 1/4W	3560331
B		RESISTOR 33K OHM 1/4W	3560333

TABLE 7-1

RM-A/O CARD

INDENT	REF DES	NOMENCLATURE	PART NO.
A		PC BD ASSY RM ACU/AAU	1020364
B		IC OPTO-ISOLATOR	4110025
B		TRANSFORMER 600 TO 600 OHM	4420008
B		TRANSISTOR SW/AMP TO-92	4140007
B		TRANSISTOR PNP SW/AMP TO-92	4140008
B		RELAY 1A 12V/1400 OHM	3520024
B		RELAY 2A 12V/730 OHM	3520023
B		DIODE. SWITCHING 100V	4130003
B		DIODE 6.8V	4130001
B		DIODE GEN PURPOSE	4130004
B		INDUCTOR 8.2UH	4420001
B		IC CMOS QUAD 2-INPUT NOR	4154001
B		IC CMOS QUAD 2-INPUT NAND	4154011
B		IC CMOS DUAL D FLIP/FLOP	4154013
B		IC CMOS TRIPLE 3-INP	4154023
B		IC CMOS 12-BIT BIN COUNTER	4154040
B		IC CMOS HEX INVERTER	4154049
B		IC CMOS ONE 8-CH ANALOG MUX	4154051
B		IC CMOS QUAD EXCLUSIVE OR	4154070
B		IC CMOS DUAL BIN UP COUNTER	4154520
B		IC OP-AMP DUAL	4110010
B		XTL 4.9152 MZ	3020003
B		PULL CARD	5000820

TABLE 7-1

RM-A/O CARD (Continued)

INDENT	REF DES	NOMENCLATURE	PART NO.
B		CAPACITOR .005UF	2220002
B		CAPACITOR 1UF 250V	2230003
B		CAPACITOR 1UF 35V	2250004
B		CAPACITOR 6.8UF	2250005
B		CAPACITOR 22UF 16V	2250011
B		CAPACITOR .01UF 50V	2260024
B		CAPACITOR .022UF 25V	2260025
B		CAPACITOR 100PF 500V	2270003
B		CAPACITOR 330PF 500V	2270007
B		RESISTOR 20 OHM 1/4W	3550200
B		RESISTOR 75K 1/4W	3550753
B		RESISTOR 1K OHM 1/4W	3560102
B		RESISTOR 10K OHM 1/4W	3560103
B		RESISTOR 100K OHM 1/4W	3560104
B		RESISTOR 1M OHM 1/4W	3560105
B		RESISTOR 1.5K 1/4W	3560152
B		RESISTOR 15M OHM 1/4W	3560156
B		RESISTOR 22K OHM 1/4W	3560223
B		RESISTOR 2.7 OHM 1/4W	3560279
B		RESISTOR 330 OHM 1/4W	3560331
B		RESISTOR 33K OHM 1/4W	3560333
B		RESISTOR 39K OHM 1/4W	3560393
B		RESISTOR 390K OHM 1/4W	3560394

TABLE 7-1

RM-A/O CARD (Continued)

INDENT	REF DES	NOMENCLATURE	PART NO.
B		RESISTOR 47K OHM 1/4W	3560473
B		RESISTOR 1.1K OHM 1/8W	3571101
B		RESISTOR 1.21K OHM 1/8W	3571211
B		RESISTOR 1.27K OHM 1/8W	3571271
B		RESISTOR 255 OHM 1/8W	3572550
B		RESISTOR 464 OHM 1/8W	3574640
B		RESISTOR 499 OHM 1/8W	3574990
B		RESISTOR 59.0K OHM 1/8W	3575902
B		RESISTOR 6.34K OHM 1/8W	3576341
B		RESISTOR 649 OHM 1/8W	3576490
B		RESISTOR 732 OHM 1/8W	3577320
B		RESISTOR 931 OHM 1/8W	3579310
B		CONNECTOR	2900003

TABLE 7-1

RM-208A MODEM CARD

INDENT	REF DES	NOMENCLATURE	PART NO.
A		PC BD ASSY 208A/B RM8	2082278
B		DIODE SWITCHING	4130003
B		DIODE 6.8V 500MW	4130001
B		TRANSFORMER 600 TO 600 OHM	4420008
B		TRANSISTOR SW/AMP TO-92	4140007
B		TRANSISTOR SIGNAL MPR TO 39	4140001
B		XTL 7.3728 MZ	3020009
B		SWITCH	4360006
B		TRANSISTOR P CHANNEL TO-92	4140019
B		TRANSIPAD	3180143
B		CONNECTOR 20 CKT	2750008
B		CONNECTOR REC.	2900003
B		PIN .025 SQ	2700069
B		LED	4190006
B		SOCKET IC 24 PIN	2730009
B		SOCKET IC 40 PIN	2730010
B		CONNECTOR 25 POS	2820001
B		RESISTOR 6 PIN 3-15K	3650008
B		RESISTOR 8 PIN 4-15K	3650009
B		RESISTOR 8 PIN 4-3.3K	3650003
B		RESISTOR 8 PIN 7-3.3K	3650011
B		RESISTOR 6 PIN 5-1.2K	3650004
B		RESISTOR 6 PIN 5-470 OHM	3650007
B		COMPARATOR	4110017

TABLE 7-1

RM-208A MODEM CARD (Continued)

INDENT	REF DES	NOMENCLATURE	PART NO.
B		IC CMOS HEX INVERTER	4154049
B		IC DUAL RS 423/232C DRIVER	4110001
B		IC QUAD RS 422/423	4110047
B		IC CMOS 2-CH ANALOG MUX	4154053
B		IC OP-AMP DUAL	4110013
B		IC DUAL OP-AMP	4110027
B		IC CMOS TRIPLE 3-INP NAND	4154023
B		IC VOLT REG. DUAL	4180004
B		IC TTL OCTAL D FLIP/FLOP	4100069
B		IC TTL HEX INVERTER	4100026
B		IC TTL 8-BIT SHIFT-REGISTER	4100110
B		IC CMOS DUAL D FLIP/FLOP	4154013
B		IC CMOS QUAD 2-INPUT NAND	4154011
B		IC TTL QUAD 2-INPUT NAND	4100099
B		IC TTL 1 OF 8 DECODER/MUX	4100061
B		IC TTL 4-BIT BINARY COUNTER	4100067
B		IC TTL HEX INVERTER	4100026
B		IC TTL TRIPLE 3INP & GATE	4100029
B		IC TTL QUAD 2-INP	4100071
B		IC TTL 8-BIT MULT ACCUM.	4100070
B		IC PROM 51 X 28	4120070
B		IC MICROCONTROLLER	4100092
B		IC TTL RAM 256 X 4	4100107

TABLE 7-1

RM-208A MODEM CARD (Continued)

INDENT	REF DES	NOMENCLATURE	PART NO.
B		IC CMOS BINARY COUNTER	4154163
B		IC PROM BIPOLAR	4100094
B		IC CMOS DUAL 4 INPUT NAND	4154012
B		IC CMOS SUCSIV	4154559
B		IC VOLTAGE COMPARATOR	4110006
B		IC TTL QUAD 2-INPUT MUX	4110064
B		IC 8-BIT D/A CONVERTER	4100093
B		CAPACITOR PP .02UF 63V	2220004
B		CAPACITOR PP .005UF 100V	2220010
B		CAPACITOR 33UF 35V	2250010
B		CAPACITOR 1UF 35	2250004
B		CAPACITOR 6.8UF 16V	2250005
B		CAPACITOR 22UF 16V	2250011
B		CAPACITOR .001U 50V	2260005
B		CAPACITOR .047U 50V	2260010
B		CAPACITOR 200PF 50V	2260003
B		CAPACITOR 47PF 100V	2260020
B		CAPACITOR .001U 50V	2260005
B		RESISTOR 300K OHM 1/4W	3550304
B		RESISTOR 75K OHM 1/4W	3550753
B		RESISTOR 5.1K OHM 1/4/W	3550512
B		RESISTOR 62K OHM 1/4W	3550623
B		RESISTOR 91K OHM 1/4W	3550913

TABLE 7-1

RM-208A MODEM CARD (Continued)

INDENT	REF DES	NOMENCLATURE	PART NO.
B		RESISTOR 1K OHM 1/4W	3560102
B		RESISTOR 10K OHM 1/4W	3560103
B		RESISTOR 100K OHM 1/4W	3560104
B		RESISTOR 12K OHM 1/4W	3560123
B		RESISTOR 15K OHM 1/4W	3560153
B		RESISTOR 22K OHM 1/4W	3560223
B		RESISTOR 220K OHM 1/4W	3560224
B		RESISTOR 330 OHM 1/4W	3560331
B		RESISTOR 3.3K OHM 1/4W	3560332
B		RESISTOR 4.7K OHM 1/4W	3560472
B		RESISTOR 5.6K OHM 1/4W	3560562
B		RESISTOR 56K OHM 1/4W	3560563
B		RESISTOR 6.8K OHM 1/4W	3560682
B		RESISTOR 680K OHM 1/4W	3560684
B		RESISTOR 6.8M OHM 1/4W	3560685
B		RESISTOR 820K OHM 1/4W	3560824
B		RESISTOR 10K OHM 1/8W	3571002
B		RESISTOR 10.2K OHM 1/8W	3571022
B		RESISTOR 102K OHM 1/8W	3571023
B		RESISTOR 107K OHM 1/8W	3571073
B		RESISTOR 110K OHM 1/8W	3571103
B		RESISTOR 115K OHM 1/8W	3571153
B		RESISTOR 11.8K OHM 1/8W	3571182

TABLE 7-1

RM-208A MODEM CARD (Continued)

INDENT	REF DES	NOMENCLATURE	PART NO.
B		RESISTOR 1.24K OHM 1/8W	3571241
B		RESISTOR 13K OHM 1/8W	3571302
B		RESISTOR 13.3K OHM 1/8W	3571332
B		RESISTOR 14.7K OHM 1/8W	3571472
B		RESISTOR 147K OHM 1/8W	3571473
B		RESISTOR 15K OHM 1/8W	3571502
B		RESISTOR 15.8K OHM 1/8W	3571582
B		RESISTOR 1.78K OHM 1/8W	3571781
B		RESISTOR 1.82K OHM 1/8W	3571821
B		RESISTOR 20K OHM 1/8W	3572002
B		RESISTOR 200K OHM 1/8W	3572003
B		RESISTOR 2.05K OHM 1/8W	3572051
B		RESISTOR 2.37K OHM 1/8W	3572371
B		RESISTOR 2.67K OHM 1/8W	3572671
B		RESISTOR 26.7K OHM 1/8W	3572672
B		RESISTOR 280K OHM 1/8W	3572803
B		RESISTOR 3.01K OHM 1/8W	3573011
B		RESISTOR 30.1K OHM 1/8W	3573012
B		RESISTOR 31.6K OHM 1/8W	3573162
B		RESISTOR 316K OHM 1/8W	3573163
B		RESISTOR 340 OHM 1/8W	3573400
B		RESISTOR 3.57K OHM 1/8W	3573571
B		RESISTOR 35.7K OHM 1/8W	3573572
B		RESISTOR 3.65K OHM 1/8W	3573651

TABLE 7-1

RM-208A MODEM CARD (Continued)

INDENT	REF DES	NOMENCLATURE	PART NO.
B		RESISTOR 37.4K OHM 1/8W	3573742
B		RESISTOR 39.2K OHM 1/8W	3573922
B		RESISTOR 4.22K OHM 1/8W	3574221
B		RESISTOR 43.2K OHM 1/8W	3574322
B		RESISTOR 4.42K OHM 1/8W	3574421
B		RESISTOR 45.3K OHM 1/8W	3574532
B		RESISTOR 47.5K OHM 1/8W	3574752
B		RESISTOR 4.99K OHM 1/8W	3574991
B		RESISTOR 5.11K OHM 1/8W	3575111
B		RESISTOR 511K OHM 1/8W	3575113
B		RESISTOR 523K OHM 1/8W	3575230
B		RESISTOR 82.5K OHM 1/8W	3578252
B		RESISTOR 53.6K OHM 1/8W	3575362
B		RESISTOR 5.49K OHM 1/8W	3575491
B		RESISTOR 54.9K OHM 1/8W	3575492
B		RESISTOR 5.62K OHM 1/8W	3575621
B		RESISTOR 66.5K OHM 1/8W	3576652
B		RESISTOR 7.15K OHM 1/8W	3577151
B		RESISTOR 71.5K OHM 1/8W	3577152
B		RESISTOR 73.2 OHM 1/8W	3577322
B		RESISTOR 76.8 OHM 1/8W	3577682
B		RESISTOR 80.6K OHM 1/8W	3578062
B		RESISTOR 866 OHM 1/8W	3578660

TABLE 7-1

RM-208A MODEM CARD (Continued)

INDENT	REF DES	NOMENCLATURE	PART NO.
B		RESISTOR 86.6K OHM 1/8W	3578662
B		RESISTOR 887 OHM 1/8W	3578870
B		RESISTOR 9.09K OHM 1/8W	3579091
B		RESISTOR 9.53 OHM 1/8W	3579531
B		RESISTOR 10 OHM 1/8W	3590100
B		PULL CARD WHITE S208	5000827
B		CAPACITOR 2200P 100V	2260030
B		RESISTOR 16.9K OHM 1/8W	3571692
B		PLATE, FRONT	5001085
B		SS FRONT PLATE	5001086
B		CAPACITOR 47PF 500V	2270002
B		RESISTOR 1.3K OHM 1/8W	3571301
B		CAPACITOR .047UF 50V	2260032

TABLE 7-1

RM-9600 MODEM CARD

INDENT	REF DES	NOMENCLATURE	PART NO.
A		PC BD ASSY RM8E/9600	2092284
B		SWITCH R/A PC TERMINALS	4360001
B		SWITCH R/A PC TR CTN OFF	4360006
B		SWITCH P.B. MOM R/A PC TR	4360077
B		TRANSISTOR P CHANNEL	4140019
B		PIN .025	2700069
B		CONNECTOR	2900003
B		HEAT SINK	3200008
B		DIODE SWITCHING 100V	4130003
B		DIODE 6.8V 500MW	4130001
B		TRANSFORMER 1500 TO 600 OHM	4420005
B		TRANSISTOR SW/AMP TO-92	4140007
B		LED	4190006
B		XTL 6.0000MZ	3020012
B		XTL 3.57945MZ	3020018
B		SOCKET IC 40 PIN	2730010
B		SOCKET IC 42 PIN	2730030
B		SOCKET IC 52 PIN	2730031
B		SOCKET IC 24 PIN	2730009
B		PLATE, FRONT	5001089
B		FRONT PLATE	5001090
B		CONNECTOR 26 CKT	2750001
B		PULL CARD WHITE 5208	5000827

TABLE 7-1

RM-9600 MODEM CARD (Continued)

INDENT	REF DES	NOMENCLATURE	PART NO.
B		CAPACITOR .001UF 100V	2220001
B		CAPACITOR .005UF 100V	2220002
B		CAPACITOR .01UF 100V	2220003
B		CAPACITOR .02UF 63V	2220004
B		CAPACITOR .03UF 63V	2220005
B		CAPACITOR .05UF 63V	2220006
B		CAPACITOR .33UF 35V	2250002
B		CAPACITOR 1UF 35V	2250004
B		CAPACITOR 6.8UF 16V	2250005
B		CAPACITOR 6.8UF 35V	2250017
B		CAPACITOR 47PF 100V	2260020
B		CAPACITOR 220P 100V	2260021
B		CAPACITOR .01UF 50V	2260009
B		CAPACITOR .001UF 50V	2260005
B		CAPACITOR .047U 50V	2260010
B		CAPACITOR .047UF 50V	2260032
B		CAPACITOR 20PF 500V	2270001
B		CAPACITOR 100PF 500V	2270003
B		CAPACITOR 200PF 500V	2270005
B		CAPACITOR 330PF 500V	2270007
B		CAPACITOR 10PF 500V	2270011
B		CAPACITOR 1000PF 100V	2270008
B		CAPACITOR 2200P 100V	2260030

TABLE 7-1

RM-9600 MODEM CARD (Continued)

INDENT	REF DES	NOMENCLATURE	PART NO.
B		IC DUAL RS-423/232C	4110001
B		IC TTL HEX INVERTER	4100026
B		IC TTL QUAD MUX	4100064
B		IC TTL QUAD NAND	4100025
B		IC QUAD EXCLUSIVE OR	4100059
B		IC CMOS 2-CH ANALOG MUX	4154053
B		IC DUAL FLIP/FLOP	4100056
B		IC QUAD V COMPARATOR	4110017
B		IC OCTL LTH TRI-STAT	4100096
B		IC QUAD Z-INP	4100045
B		IC QUAD RS442/423	4100047
B		IC TTL 8-BIT SHIFT REGISTER	4100068
B		IC MICROPROCESSOR 8-BIT	4120021
B		IC LINEAR DUAL TIMER	4120044
B		IC EPROM 16K	4120024
B		IC DECADE COUNTER	4100075
B		IC RAM 2K I/O PORT + TIMER	4120054
B		IC LSI CLOCK CHIP	4200008
B		IC 8-BIT D-TO-A CONVERTER	4110046
B		IC OP-AMP DUAL	4110013
B		IC LST TRANSMIT	4200001
B		IC LSI TRANSMIT CHIP	4200005
B		IC LSI EQUALIZER CHIP	4200003

TABLE 7-1

RM-9600 MODEM CARD (Continued)

INDENT	REF DES	NOMENCLATURE	PART NO.
B		IC LSI RECEIVER CHIP	4200004
B		IC DECISION CHIP	4200006
B		IC VOLT REGULATOR DUAL	4180004
B		IC LSI A2D	4200002
B		IC LSI REC LEARNING CHIP	4200007
B		IC DUAL OP-AMP	4110027
B		RESISTOR 20K OHM 1/4W	3550203
B		RESISTOR 75K OHM 1/4W	3550753
B		RESISTOR 510K OHM 1/4W	3550514
B		RESISTOR 62K OHM 1/4W	3550623
B		RESISTOR 1K OHM 1/4W	3560102
B		RESISTOR 10K OHM 1/4W	3560103
B		RESISTOR 100K OHM 1/4W	3560104
B		RESISTOR 1.2K OHM 1/4W	3560122
B		RESISTOR 12K OHM 1/4W	3560123
B		RESISTOR 1.5K OHM 1/4W	3560152
B		RESISTOR 15K OHM 1/4W	3560153
B		RESISTOR 1.8K OHM 1/4W	3560182
B		RESISTOR 3.3 OHM 1/4W	3560332
B		RESISTOR 470 OHM 1/4W	3560471
B		RESISTOR 4.7K OHM 1/4W	3560472
B		RESISTOR 6.8K OHM 1/4W	3560682
B		RESISTOR 680K OHM 1/4W	3560684

TABLE 7-1

RM-9600 MODEM CARD (Continued)

INDENT	REF DES	NOMENCLATURE	PART NO.
B		RESISTOR 6.8M OHM 1/4W	3560685
B		RESISTOR 1K OHM 1/8W	3571001
B		RESISTOR 10K OHM 1/8W	3571002
B		RESISTOR 10.7K OHM 1/8W	3571072
B		RESISTOR 11.3K OHM 1/8W	3571132
B		RESISTOR 115K OHM 1/8W	3571153
B		RESISTOR 12.4K OHM 1/8W	3571242
B		RESISTOR 14.7K OHM 1/8W	3571472
B		RESISTOR 15K OHM 1/8W	3571502
B		RESISTOR 154K OHM 1/8W	3571543
B		RESISTOR 15.8K OHM 1/8W	3571582
B		RESISTOR 1.62K OHM 1/8W	3571621
B		RESISTOR 16.2K OHM 1/8W	3571622
B		RESISTOR 16.9K OHM 1/8W	3571692
B		RESISTOR 1.78K OHM 1/8W	3571781
B		RESISTOR 18.7K OHM 1/8W	3571872
B		RESISTOR 1.96K OHM 1/8W	3571961
B		RESISTOR 20K OHM 1/8W	3572002
B		RESISTOR 2.05K OHM 1/8W	3572051
B		RESISTOR 2.15K OHM 1/8W	3572151
B		RESISTOR 23.2K OHM 1/8W	3572322
B		RESISTOR 24.3K OHM 1/8W	3572432
B		RESISTOR 2.49K OHM 1/8W	3572491

TABLE 7-1

RM-9600 MODEM CARD (Continued)

INDENT	REF DES	NOMENCLATURE	PART NO.
B		RESISTOR 3.01K OHM 1/8W	3573011
B		RESISTOR 30.1K OHM 1/8W	3573012
B		RESISTOR 3.57K OHM 1/8W	3573571
B		RESISTOR 3.65K OHM 1/8W	3573651
B		RESISTOR 36.5K OHM 1/8W	3573652
B		RESISTOR 38.3K OHM 1/8W	3573832
B		RESISTOR 3.92K OHM 1/8W	3573921
B		RESISTOR 40.2K OHM 1/8W	3574022
B		RESISTOR 4.12K OHM 1/8W	3574121
B		RESISTOR 41.2K OHM 1/8W	3574122
B		RESISTOR 4.22K OHM 1/8W	3574221
B		RESISTOR 422K OHM 1/8W	3574420
B		RESISTOR 4.42K OHM 1/8W	3574421
B		RESISTOR 46.4K OHM 1/8W	3574642
B		RESISTOR 4.75K OHM 1/8W	3574751
B		RESISTOR 4.87K OHM 1/8W	3574871
B		RESISTOR 51.1K OHM 1/8W	3575112
B		RESISTOR 511K OHM 1/8W	3575113
B		RESISTOR 5.62K OHM 1/8W	3575621
B		RESISTOR 43.2K OHM 1/8W	3574322
B		RESISTOR 57.6K OHM 1/8W	3575762
B		RESISTOR 59.0K OHM 1/8W	3575902
B		RESISTOR 6.340K OHM 1/8W	3576341

TABLE 7-1

RM-9600 MODEM CARD (Continued)

INDENT	REF DES	NOMENCLATURE	PART NO.
B		RESISTOR 66.5K OHM 1/8W	3576652
B		RESISTOR 71.5K OHM 1/8W	3577152
B		RESISTOR 76.8K OHM 1/8W	3577682
B		RESISTOR 80.6K OHM 1/8W	3578062
B		RESISTOR 82.5K OHM 1/8W	3578252
B		RESISTOR 8.45K OHM 1/8W	3578451
B		RESISTOR 8.66K OHM 1/8W	3578661
B		RESISTOR 909K OHM 1/8W	3579093
B		RESISTOR 9.53K OHM 1/8W	3579531
B		RESISTOR 9.76K OHM 1/8W	3579761
B		POTENTOMETER 200 OHM	3640012
B		RESISTOR 220K OHM 1/4W	3560224
B		RESISTOR 4.99K OHM 1/8W	3574991
B		RESISTOR 220K OHM 1/4W	3560224
B		RESISTOR 4.99K OHM 1/8W	3574991
B		RESISTOR 33K OHM 1/4W	3560333

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